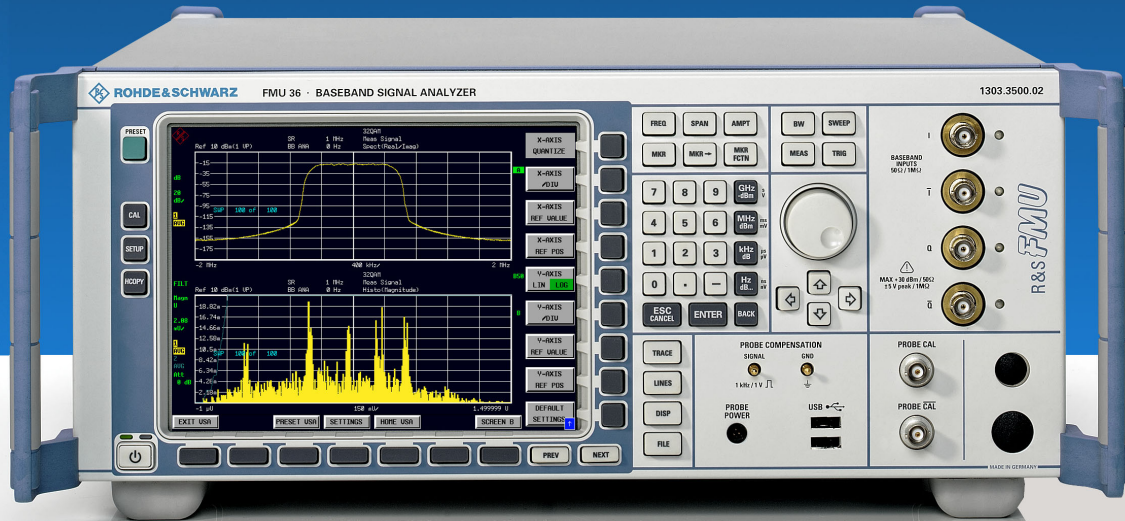


Quick Start Guide



Baseband Signal Analyzer

R&S® FMU36

1303.3500.02

Printed in Germany



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Certificate of Quality

Support Center Address

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Before putting the product into operation for the first time, make sure to read the following

Safety Instructions



All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standard of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment required for them are designed and tested in accordance with the relevant safety standards. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for an intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and a basic knowledge of English. It is therefore essential that the product be used exclusively by skilled and specialized staff or thoroughly trained personnel with the required skills. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation.

Symbols and safety labels

Observe product documentation	Weight indication for units >18 kg	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Attention! Electrostatic sensitive devices

Supply voltage ON/OFF	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double/reinforced insulation

Safety Instructions

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before putting the product into operation. It is also absolutely essential to observe the additional safety instructions on personal safety that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories.

Tags and their meaning

DANGER	This tag indicates a definite hazard carrying a high risk of death or serious injury if not avoided.
WARNING	This tag indicates a possible hazard carrying a medium risk of death or (serious) injury if not avoided.
CAUTION	This tag indicates a hazard carrying a low risk of minor or moderate injury if not avoided.
ATTENTION	This tag indicates the possibility of incorrect use that can cause damage to the product.
NOTE	This tag indicates a situation where the user should pay special attention to operating the product but which does not lead to damage.

These tags are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the tags described here are always used only in connection with the related product documentation and the related product. The use of tags in connection with unrelated products or documentation can result in misinterpretation and thus contribute to personal injury or material damage.

Basic safety instructions

- The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products:
prescribed operating position is always with the housing floor facing down, IP protection 2X,
pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 2000 m above sea level, max. transport altitude 4500 m above sea level.
Unless specified otherwise in the data sheet, a tolerance of $\pm 10\%$ shall apply to the nominal voltage and of $\pm 5\%$ to the nominal frequency.

Safety Instructions

2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test).
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.
4. If products/components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
5. If handling the product yields hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation.
6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer/operator is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.
7. Operating the products requires special training and intense concentration. Make certain that persons who use the products are physically, mentally and emotionally fit enough to handle operating the products; otherwise injuries or material damage may occur. It is the responsibility of the employer to select suitable personnel for operating the products.
8. Prior to switching on the product, it must be ensured that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.

Safety Instructions

9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.
10. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.
12. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.
13. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, this can result in sparks, fire and/or injuries.
15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
16. For measurements in circuits with voltages $V_{\text{rms}} > 30 \text{ V}$, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.
18. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
19. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a license electrician.
20. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that suitable protection is provided for users and products.
21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.

Safety Instructions

22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.
23. Rohde & Schwarz products are not protected against penetration of water, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock for the user or damage to the product, which can also lead to personal injury.
24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.
25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.
26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.
27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. Do not short-circuit batteries and storage batteries.
If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells).
- Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries must be recycled and kept separate from residual waste. Batteries and storage batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.
28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.
29. The product can be very heavy. Be careful when moving it to avoid back or other physical injuries.
30. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves).
31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.

Safety Instructions

32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle. The manufacturer assumes no responsibility for accidents or collisions.
33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the product documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.



Por favor lea imprescindiblemente antes de la primera puesta en funcionamiento las siguientes











Informaciones de seguridad







El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los standards de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE y ha salido de nuestra planta en estado impecable según los standards técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las informaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto solamente fue elaborado para ser utilizado en la industria y el laboratorio o para fines de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda ser dañada. El uso del producto fuera de sus fines definidos o despreciando las informaciones de seguridad del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado dentro de las instrucciones de la correspondiente documentación de producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos profundos y conocimientos parciales del idioma inglés. Por eso se deberá tener en cuenta de exclusivamente autorizar para el uso del producto a personas peritas o debidamente minuciosamente instruidas con los conocimientos citados. Si fuera necesaria indumentaria de seguridad para el uso de productos de R&S, encontrará la información debida en la documentación del producto en el capítulo correspondiente.

Símbolos y definiciones de seguridad

							
Ver documentación de producto	Informaciones para maquinaria con un peso de > 18kg	Peligro de golpe de corriente	¡Advertencia! Superficie caliente	Conexión a conductor protector	Conexión a tierra	Conexión a masa conductora	¡Cuidado! Elementos de construcción con peligro de carga electrostática

					
potencia EN MARCHA/PARADA	Indicación Stand-by	Corriente continua DC	Corriente alterna AC	Corriente continua/alterna DC/AC	El aparato está protegido en su totalidad por un aislamiento de doble refuerzo

Tener en cuenta las informaciones de seguridad sirve para tratar de evitar daños y peligros de toda clase. Es necesario de que se lean las siguientes informaciones de seguridad concienzudamente y se tengan en cuenta debidamente antes de la puesta en funcionamiento del producto. También deberán ser tenidas en cuenta las informaciones para la protección de personas que encontrarán en el capítulo correspondiente de la documentación de producto y que también son obligatorias de seguir. En las informaciones de seguridad actuales hemos juntado todos los objetos vendidos por el grupo de empresas Rohde & Schwarz bajo la denominación de „producto“, entre ellos también aparatos, instalaciones así como toda clase de accesorios.

Palabras de señal y su significado

- PELIGRO** Identifica un peligro directo con riesgo elevado de provocar muerte o lesiones de gravedad si no se toman las medidas oportunas.
- ADVERTENCIA** Identifica un posible peligro con riesgo medio de provocar muerte o lesiones (de gravedad) si no se toman las medidas oportunas.
- ATENCIÓN** Identifica un peligro con riesgo reducido de provocar lesiones de gravedad media o leve si no se toman las medidas oportunas.
- CUIDADO** Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo.
- INFORMACIÓN** Indica una situación en la que deberían seguirse las instrucciones en el uso del producto, pero que no consecuentemente deben de llevar a un daño del mismo.

Informaciones de seguridad

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el área económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación de producto y solamente en combinación con el producto correspondiente. La utilización de las palabras de señal en combinación con productos o documentaciones que no les correspondan puede llevar a malinterpretaciones y tener por consecuencia daños en personas u objetos.

Informaciones de seguridad elementales

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento sin que se obstruya la ventilación. Si no se convino de otra manera, es para los productos R&S válido lo que sigue: como posición de funcionamiento se define principalmente la posición con el suelo de la caja para abajo, modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4.500 m sobre el nivel del mar.
A menos que se especifique otra cosa en la hoja de datos, se aplicará una tolerancia de $\pm 10\%$ sobre el voltaje nominal y de $\pm 5\%$ sobre la frecuencia nominal.
2. En todos los trabajos deberán ser tenidas en cuenta las normas locales de seguridad de trabajo y de prevención de accidentes. El producto solamente debe de ser abierto por personal perito autorizado. Antes de efectuar trabajos en el producto o abrirlo deberá este ser desconectado de la corriente. El ajuste, el cambio de partes, la manutención y la reparación deberán ser solamente efectuadas por electricistas autorizados por R&S. Si se reponen partes con importancia para los aspectos de seguridad (por ejemplo el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada recambio de partes elementales para la seguridad deberá ser efectuado un control de seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de medición de la corriente conductora, control de funcionamiento).
3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se produjeran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averiguar los motivos de estas reacciones.

Informaciones de seguridad

4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.
5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberán ser tenidas en cuenta las prescripciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescripciones de seguridad especiales en la descripción del producto.
6. Ciertos productos, como por ejemplo las instalaciones de radiación HF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética. El empresario/usuario está comprometido a valorar y señalar áreas de trabajo en las que se corra un riesgo aumentado de exposición a radiaciones para evitar riesgos.
7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.
8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del prodcuto.
9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.
10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto. Puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro, que es controlado su estado técnico de seguridad.

Informaciones de seguridad

11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurarse de que el enchufe sea de fácil acceso y nabejo (según la medida del cable de distribución, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en construcciones o instalaciones, se deberá instalar el interruptor al nivel de la instalación.
12. No utilice nunca el producto si está dañado el cable eléctrico. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.
13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A (utilización de fusibles de mayor amperaje sólo previa consulta con el grupo de empresas Rohde & Schwarz).
14. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.
15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.
16. En las mediciones en circuitos de corriente con una tensión de entrada de $U_{\text{eff}} > 30 \text{ V}$ se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos de la EC950/EN60950.
18. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar heridas, fuego o daños en el producto.
19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, el circuito de suministro de corriente deberá estar protegido de manera que usuarios y productos estén suficientemente protegidos.
21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir corto circuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.

Informaciones de seguridad

22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.
23. Los productos R&S no están protegidos contra el agua si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente para el usuario o de daños en el producto lo cual también puede llevar al peligro de personas.
24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.
25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.
26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.
27. Baterías y acumuladores no deben de ser expuestos a temperaturas altas o al fuego. Guardar baterías y acumuladores fuera del alcance de los niños. No cortocircuitar baterías ni acumuladores. Si las baterías o los acumuladores no son cambiados con la debida atención existirá peligro de explosión (atención celulas de Litio). Cambiar las baterías o los acumuladores solamente por los del tipo R&S correspondiente (ver lista de piezas de recambio). Las baterías y acumuladores deben reutilizarse y no deben acceder a los vertederos. Las baterías y acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de evacuación y reciclaje.
28. Por favor tengan en cuenta que en caso de un incendio pueden desprenderse del producto agentes venenosos (gases, líquidos etc.) que pueden generar daños a la salud.
29. El producto puede poseer un peso elevado. Muévelo con cuidado para evitar lesiones en la espalda u otras partes corporales.
30. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptas para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (por ejemplo paredes y estantes).

Informaciones de seguridad

31. Las asas instaladas en los productos sirven solamente de ayuda para el manejo que solamente está previsto para personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como por ejemplo grúas, carretillas elevadoras de horquilla, carros etc. El usuario es responsable de que los productos sean sujetados de forma segura a los medios de transporte y de que las prescripciones de seguridad del fabricante de los medios de transporte sean tenidas en cuenta. En caso de que no se tengan en cuenta pueden causarse daños en personas y objetos.
32. Si llega a utilizar el producto dentro de un vehículo, queda en la responsabilidad absoluta del conductor que conducir el vehículo de manera segura. Asegure el producto dentro del vehículo debidamente para evitar en caso de un accidente las lesiones u otra clase de daños. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Siempre queda en la responsabilidad absoluta del conductor la seguridad del vehículo. El fabricante no asumirá ninguna clase de responsabilidad por accidentes o colisiones.
33. Dado el caso de que esté integrado un producto de laser en un producto R&S (por ejemplo CD/DVD-ROM) no utilice otras instalaciones o funciones que las descritas en la documentación de producto. De otra manera pondrá en peligro su salud, ya que el rayo laser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo laser.

Certified Quality System

DIN EN ISO 9001 : 2000

DIN EN 9100 : 2003

DIN EN ISO 14001 : 2004

DQS REG. NO 001954 QM UM

QUALITÄTSZERTIFIKAT

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Managementsystems entwickelt, gefertigt und geprüft.

Das Rohde & Schwarz Managementsystem ist zertifiziert nach:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004

CERTIFICATE OF QUALITY

Dear Customer,

you have decided to buy a Rohde & Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards.

The Rohde & Schwarz quality management system is certified according to:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004

CERTIFICAT DE QUALITÉ

Cher Client,

vous avez choisi d'acheter un produit Rohde & Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité.

Le système de gestion qualité de Rohde & Schwarz a été homologué conformément aux normes:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:2004



ROHDE & SCHWARZ



Certificate No.: 2006-76

This is to certify that:

Equipment type	Stock No.	Designation
FMU36	1303.3500.02	Baseband Signal Analyzer

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits
(73/23/EEC revised by 93/68/EEC)
- relating to electromagnetic compatibility
(89/336/EEC revised by 91/263/EEC, 92/31/EEC, 93/68/EEC)

Conformity is proven by compliance with the following standards:

EN 61010-1 : 2001
EN 55011 : 1998 + A1 : 1999 + A2 : 2002, Klasse B
EN 61326 : 1997 + A1 : 1998 + A2 : 2001 + A3 : 2003
EN 61000-3-2 : 2000 + A2 : 2005
EN 61000-3-3 : 1995 + A1 : 2001

For the assessment of electromagnetic compatibility, the limits of radio interference for Class B equipment as well as the immunity to interference for operation in industry have been used as a basis.

Affixing the EC conformity mark as from 2006

ROHDE & SCHWARZ GmbH & Co. KG
Mühlendorfstr. 15, D-81671 München

Munich, 2006-11-23

Central Quality Management MF-QZ / Radde

Customer Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

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To keep your Rohde & Schwarz equipment always up-to-date, please subscribe to our electronic newsletter at

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Documentation Overview

The documentation of the R&S FMU consists of base unit manuals and option manuals. All manuals are provided in PDF format on the CD-ROM delivered with the instrument. Each software option available for the instrument is described in a separate software manual.

The base unit documentation comprises the following manuals:

- [R&S FMU Quick Start Guide](#)
- [R&S FMU Operating Manual](#)
- [R&S FMU Service Manual](#)

Apart from the base unit, these manuals describe the models and options of the R&S FMU Baseband Signal Analyzer that are listed in the documentation overview of the Operating Manual. All other options are described in separate manuals. These manuals are provided on the CD-ROM. For an overview of all options available for the R&S FMU visit the R&S FMU Baseband Signal Analyzer Internet site.

R&S FMU Quick Start Guide

This manual is delivered with the instrument in printed form and in PDF format on the CD-ROM. It provides the information needed to set up and start working with the instrument. Basic operations and basic measurements are described. Also a brief introduction to remote control is given. More detailed descriptions are provided in the Operating Manual. The Quick Start Guide includes general information (e.g. Safety Instructions) and the following chapters:

Chapter 1	Front and Rear Panel
Chapter 2	Preparing for Use
Chapter 3	Firmware-Update and Installation of Firmware Options
Chapter 4	Basic Operation
Chapter 5	Basic Measurement Examples
Chapter 6	LAN Interface
Chapter 7	Brief Introduction to Remote Control
Appendix A	Printer Interface

R&S FMU Operating Manual

This manual is a supplement to the Quick Start Guide and is available in PDF format on the CD-ROM delivered with the instrument. To retain the familiar structure that applies to all operating manuals of Rohde&Schwarz Test & Measurement instruments, the chapters 1 and 3 exist, but only in form of references to the corresponding Quick Start Guide chapters.

The operating manual is subdivided into the following chapters:

Chapter 1	Putting into Operation see Quick Start Guide chapters 1 and 2
Chapter 2	Getting Started gives an introduction to advanced measurement tasks of the R&S FMU which are explained step by step.

Chapter 3	Manual Operation see Quick Start Guide chapter 4
Chapter 4	Instrument Functions forms a reference for manual operation of the R&S FMU and contains a detailed description of all instrument functions and their application.
Chapter 5	Remote Control - Basics describes the basics for programming the R&S FMU, command processing and the status reporting system.
Chapter 6	Remote Control - Description of Commands lists all the remote-control commands defined for the instrument.
Chapter 7	Remote Control - Programming Examples contains program examples for a number of typical applications of the R&S FMU.
Chapter 8	Maintenance and Instrument Interfaces describes preventive maintenance and the characteristics of the instrument's interfaces.
Chapter 9	Error Messages gives a list of error messages that the R&S FMU may generate.
Index	contains an index for the chapters 1 to 9 of the operating manual.

R&S FMU Service Manual

This manual is available in PDF format on the CD-ROM delivered with the instrument. It informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the R&S FMU by the replacement of modules. The manual includes the following chapters:

Chapter 1	Performance Test
Chapter 2	Adjustment
Chapter 3	Repair
Chapter 4	Software Update / Installing Options
Chapter 5	Documents

1 Front and Rear Panel

Front View

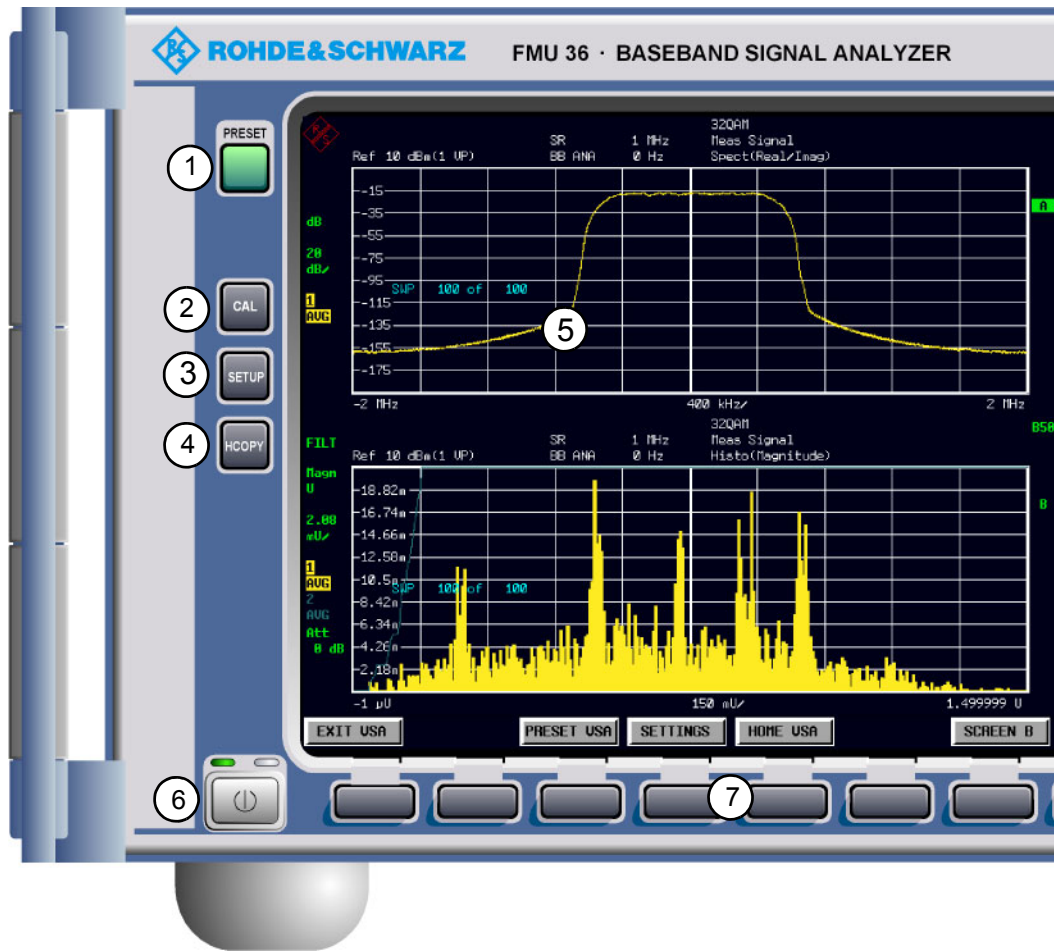
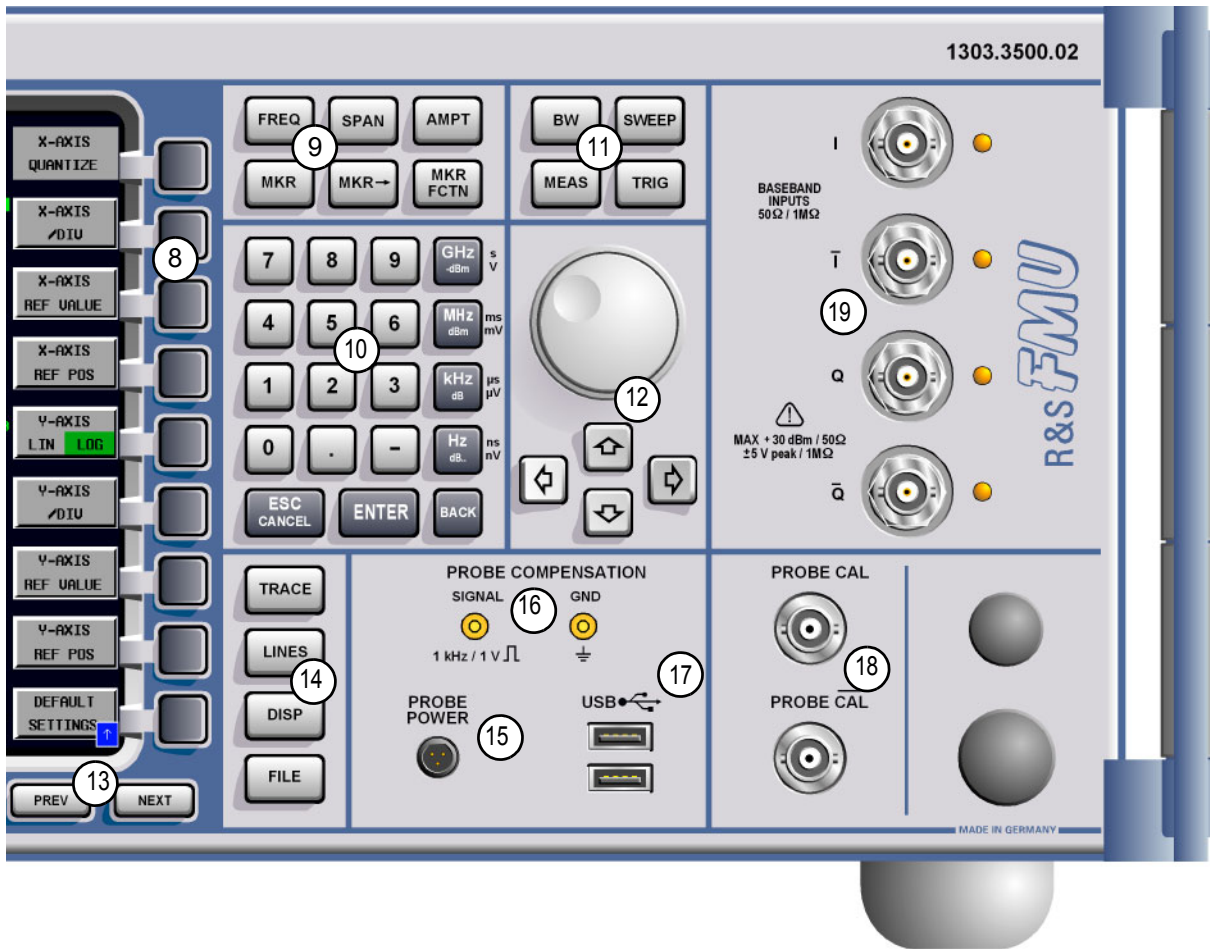


Fig. 1-1 Front view

Number in Fig. 1-1	Description
1	PRESET key (see “Function Keys on the Front Panel”)
2	Calibration key (see “Function Keys on the Front Panel”)
3	SETUP key (see “Function Keys on the Front Panel”)
4	HCOPI key (see “Function Keys on the Front Panel”)
5	screen
6	ON/standby switch (see “Function Keys on the Front Panel”)
7	hotkeys
8	softkeys
9	function keys for frequency, level, and markers (see “Function Keys on the Front Panel”)
10	numeric keypad, units and entry keys



Number in Fig. 1-1	Description
11	function keys for bandwidth, sweep, trigger, and measurement functions (see “Function Keys on the Front Panel”)
12	rotary knob with enter function and arrow keys
13	<i>PREVIOUS</i> key, <i>NEXT</i> key (softkey side menus)
14	<i>TRACE</i> key, <i>LINES</i> key, <i>DISP</i> key, <i>FILE</i> key (see “Function Keys on the Front Panel”)
15	probe power connector (see page 6)
16	probe compensation connectors (see page 6)
17	USB interfaces (see page 6)
18	probe calibration (see page 7)
19	baseband input (see page 7)

Function Keys on the Front Panel

A detailed description of the corresponding menus and the other function keys is provided in the Operating Manual on CD-ROM.

Function key	Assigned functions
ON / STANDBY	Switches the instrument on and off.
PRESET	Resets the instrument to the default state.
FREQ	Sets the center frequency as well as the start and stop frequencies for the frequency band under consideration. This key is also used to set the frequency offset.
SPAN	Sets the frequency span to be analyzed.
AMPT	Sets the reference level, the displayed dynamic range, the unit for the level display. This key is also used to set the level offset.
MKR	Sets and positions the absolute and relative measurement markers (markers and delta markers). In addition, the following measurement functions are assigned under this key: <ul style="list-style-type: none"> • Fixed reference point for relative measurement markers (<i>REFERENCE FIXED</i>)
MKR->	Used for search functions of the measurement markers (maximum/minimum of the trace). Assigns the marker frequency to the center frequency. Restricts the search area (<i>SEARCH LIMITS</i>) and characterizes the maximum points and minimum points (<i>PEAK EXCURSION</i>).
MKR FCTN	Provides additional analysis functions of the measurement markers: <ul style="list-style-type: none"> • Noise marker (<i>NOISE MEAS</i>) • Phase noise (<i>PHASE NOISE</i>) • n dB down function • Peak list
BW	Sets the resolution bandwidth and the ratio "span/resolution bandwidth" in the case of automatic coupling.
SWEEP	Sets the sweep time and the number of measurement points. Selects continuous measurement or single measurement.
MEAS	Used to perform complex measurement functions: <ul style="list-style-type: none"> • Measurement of time domain power (<i>TIME DOM POWER</i>) • Measurement of channel and adjacent channel power (<i>CHAN PWR ACP</i>) • Measurement of multicarrier adjacent channel power (<i>MULT CARR ACP</i>) • Occupied bandwidth (<i>OCCUPIED BANDWIDTH</i>) • Signal statistics (<i>SIGNAL STATISTIC</i>): amplitude probability distribution (APD) and cumulative complementary distribution function (CCDF) • Carrier to noise spacing (<i>C/N C/No</i>) • AM modulation depth (<i>MODULATION DEPTH</i>)
TRIG	Sets trigger source, trigger threshold, trigger delay.

Function key	Assigned functions
TRACE	Configures measured data acquisition (<i>CLR/WRITE</i> ; <i>AVERAGE</i> , <i>MAXHOLD</i> ; <i>MINHOLD</i> , <i>VIEW</i>). Configures the analysis of the measurement data (<i>DETECTOR</i>) and the mathematical linking of traces (<i>TRACE MATH</i>).
LINES	Configures display lines and limit lines.
DISP	Configures the screen layout (one/two diagrams) and the diagram contents. This key can also be used to configure the screen colors.
FILE	Provides the functions for storing/loading instrument settings and for managing stored files.
CAL	Used to perform instrument self-calibration and probe calibration.
SETUP	Used to set or display the following the default settings of the instrument: <ul style="list-style-type: none"> • Reference frequency, date, time, GPIB, RS-232-C interface, LAN interface • Firmware update and enabling of options • Information about instrument configuration (<i>SYSTEM INFO</i>) incl. firmware version, module data and system error messages • Service support functions
HCOPY	Configures the screen printout, and selects and configures the printer.

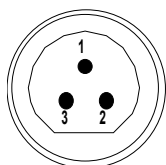
Front Panel Connections

This section describes the front connectors and interfaces of the R&S FMU. Optional connectors and interfaces are indicated by the option name in brackets.

PROBE POWER

To allow you to connect transducers from other manufacturers, the R&S FMU provides a PROBE POWER supply connector.

The connector supplies the +15 V and –12.6 V supply voltages and ground. This connector is suitable for supplying high-impedance probes from Agilent.



Pin	Signal
1	GND
2	-12.6 V; max 150 mA
3	+15 V; max 150 mA

Fig. 1-2 Pin assignments of PROBE POWER connector

USB Interfaces

The R&S FMU provides a USB female connector at the front panel for connecting two USB devices (USB 2.0).



ATTENTION

Use suitable double shielded cables.

Use only USB devices that keep the permissible EMI limits.

PROBE COMPENSATION

To align high-impedance 10:1 probes, the R&S FMU provides a PROBE COMPENSATION connector. A 1 V / 1 kHz rectangular signal is output.

PROBE CAL

The PROBE CAL connector allows you to calibrate measurement cables and probes.

The output signal is adjustable:

- Precise DC voltage to calibrate attenuation and offset (0 to 2.5 V)
- Pulse (comb spectrum) to calibrate the frequency response (1 V)
- 1 kHz 10:1 probes (signal details see [PROBE COMPENSATION](#))

The PROBE $\overline{\text{CAL}}$ connector supplies the inverted signal for the simultaneous calibration of two probes in a differential measurement.

The signals are adjusted automatically during probe calibration. In a test setup you can also adjust the signals manually (Probe Cal menu).

BASEBAND INPUTS

The four female connectors at the front panel are provided to connect real or complex baseband signal sources or IF signals. An attenuator to -15 dB is located at the input to prevent overloading of the A/D converter. The input impedance is switchable from 50 Ω to 1 M Ω . The maximum safe input power/voltage is 30 dBm for 50 Ω and 5 V peak for 1M Ω .

Devices under test, e.g. a complex modulation source, are connected to inputs I and Q. Differential sources are connected to I, \bar{I} , Q and \bar{Q} , the inverted signal is connected to \bar{I} and \bar{Q} .

Rear View

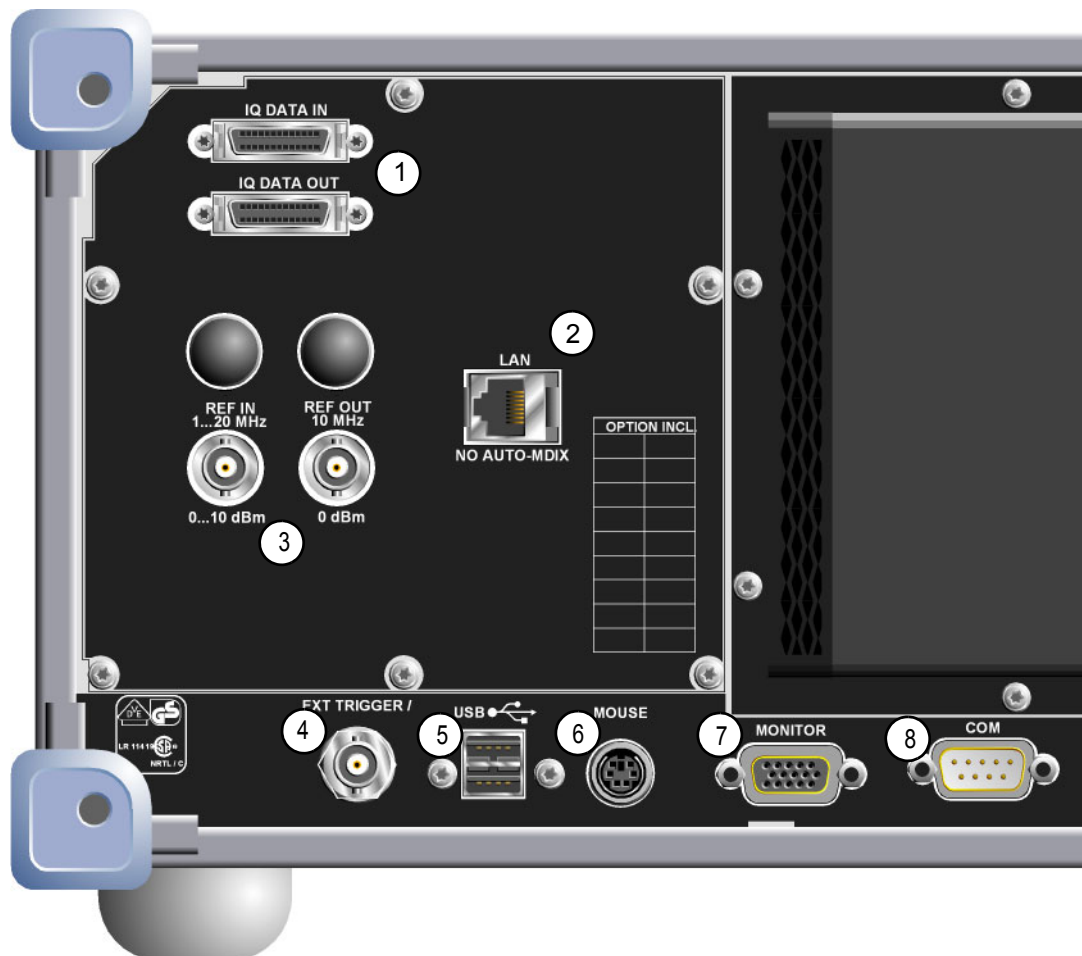
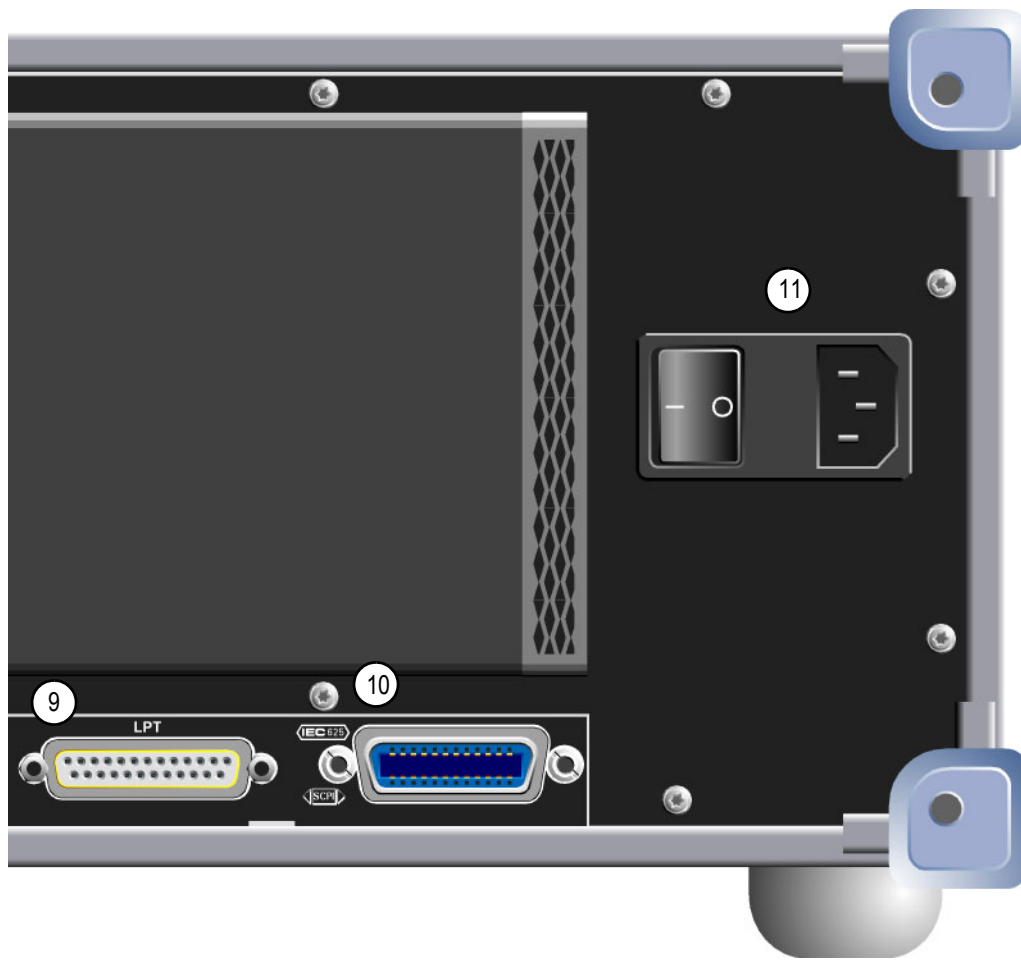


Fig. 1-3 Rear view

Number in Fig. 1-3	Description
1	IQ data input/output (see page 13)
2	LAN interface (see page 14)
3	reference input and output (see page 14)
4	trigger interface (see page 13)
5	double USB interface (see page 12)
6	mouse interface (see page 11)



Number in Fig. 1-3	Description
7	VGA interface for external monitor (see page 11)
8	RS232-C interface (see page 10)
9	LPT printer interface (see page 10)
10	GPIB interface for remote control (see page 10)
11	AC power supply connector with on/off switch (see page 10)

Rear Panel Connections

This section describes the rear connectors and interfaces of the R&S FMU. Optional connectors and interfaces are indicated by the option name in brackets.

AC Power Supply Connection and Main Power Switch

An AC power supply connector and main power switch are located in a unit on the rear panel of the instrument.

Main power switch function:

- Position I** After being switched on, the instrument will be either in STANDBY mode or in operation depending on the setting of the ON/STANDBY switch on the front panel of the instrument.
- Position O** Switching the instrument off disconnects the entire instrument from the AC power supply.



Note

The main power switch also interrupts the power supply of the OCXO (optional) located in the instrument. When you switch the instrument back on, be sure to comply with the extended warm-up phase specified in the data sheet.

GPIB Interface

The instrument comes with a GPIB interface in compliance with IEEE488. A controller for remote control can be connected via this interface. Use a shielded cable to set up the connection. For further information refer to the Operating Manual, chapter 8.

Printer Interface (LPT)

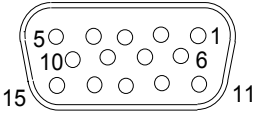
The 25-pin female LPT connector on the rear panel of the R&S FMU is provided for connecting a printer. The interface is compatible with the CENTRONICS interface. For further information refer to the Operating Manual, chapter 8.

RS-232-C Interface (COM)

The instrument comes with an RS-232-C interface. The interface can be manually activated and configured for remote control by defining the parameters in the *COM INTERFACE* table, which is accessed from the *SETUP-GENERAL SETUP* menu. For further information refer to the Operating Manual, chapter 8.

R&S Monitor Connection (MONITOR)

The 15-pin VGA monitor connection is used to display the screen contents on an external screen. The procedure for putting the external monitor into operation is described in the section “Connecting an External Monitor” on page 2.8.

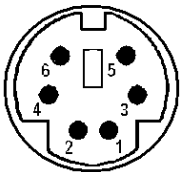


Pin	Signal	Pin	Signal
1	R	9	GND
2	G	10	GND
3	B	11	(NC)
4	(NC)	12	(NC)
5	GND	13	HSYNC
6	GND	14	VSYNC
7	GND	15	(NC)
8	GND		

Fig. 1-4 Pin assignments of the MONITOR connection

Mouse Connection (MOUSE)

A PS/2 connector is provided at the rear panel to connect a PS/2 mouse.



Pin	Signal
1	MOUSEDATA
2	KEYBOARDDATA
3	MOUSEGND
4	MOUSEVD5
5	MOUSECLK
6	KEYBOARDCLK

Fig. 1-5 Pin assignments for the MOUSE connection

USB Interface

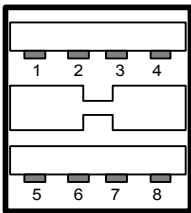
The R&S FMU provides two USB female connectors at the rear panel for connecting two USB devices (upper connector USB 1.1, lower connector USB 2.0).



ATTENTION

Use suitable double shielded cables. Passive USB connecting cables must not exceed 1 m in length.

Use only USB devices that keep the permissible EMI limits.



Pin	Signal
1	+ 5 V USB0
2	USBDATA0 -
3	USBDATA0 +
4	GND
5	+ 5 V USB1
6	USBDATA1 -
7	USBDATA1 +
8	GND

Fig. 1-6 USB connector assignment

IQ DATA IN/IQ DATA OUT

The connectors is used to input and output IQ signals as LVDS signals.

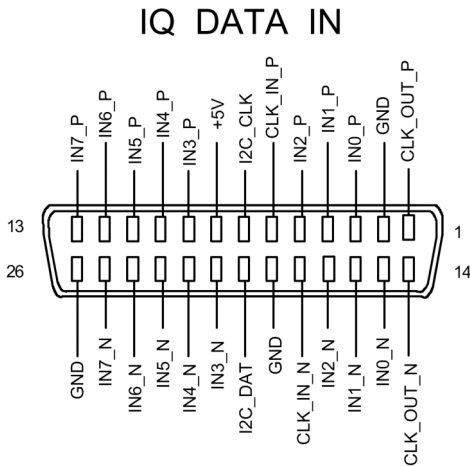


Fig. 1-7 IQ data input connector assignment

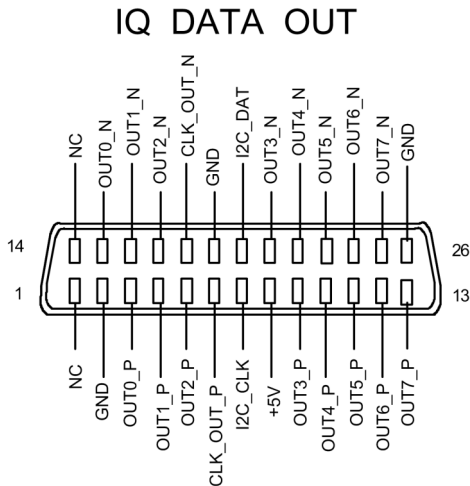


Fig. 1-8 IQ data output connector assignment

Input for External Trigger (EXT TRIG)

The EXT TRIG female connector is used to control the measurement by means of an external signal.

The trigger level can be varied in the range from 0.5 to 3.5 V. The typical input impedance is 10 kΩ.

Reference Input and Output (REF IN and REF OUT)

The REF IN female connector is used as an input for a 1 to 20 MHz reference signal. The required input level is ≥ 0 dBm. The REF OUT female connector provides the internal 10 MHz reference signal with a typical 10 dBm output level for other devices.

The *SETUP* menu is used to select between the internal and external references.

If an external reference is used for operation, the external reference signal from REF IN is looped through to REF OUT.

LAN Interface

The LAN interface can be used to connect to a local network. The assignment of the RJ-45 connector supports twisted-pair category 5 UTP/STP cables in a star configuration (UTP stands for “unshielded twisted pair”, and STP for “shielded twisted pair”).

2 Preparing for Use

Preparing for Operation

This section describes how to put the instrument into operation.



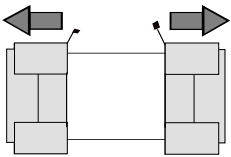
ATTENTION

Before putting the instrument into operation, make sure that the following requirements have been met:

- The air vents are not blocked.
- No signal voltage levels exceeding the permitted limits are present at the inputs.
- The instrument's outputs are neither overloaded nor incorrectly connected.

Not complying with these requirements can result in damage to the instrument.

Unpacking the Instrument



Remove protective caps

- Remove the instrument from its packaging and check the shipment against the packing list to ensure that all items are included. Check the list of accessories for separate articles.
- Remove the two protective covers on the front and rear panels of the R&S FMU and carefully check the instrument for any damage.
- If you find any damage, immediately notify the shipping company. In this case, do not discard the box and packaging material.
- Retain the original packaging in the event that you need to move or ship the R&S FMU in the future in order to avoid any damage to the operating elements and connections. Rohde & Schwarz will accept claims as covered in the warranty only if the instrument is shipped with adequate packaging.

Setting Up the Instrument

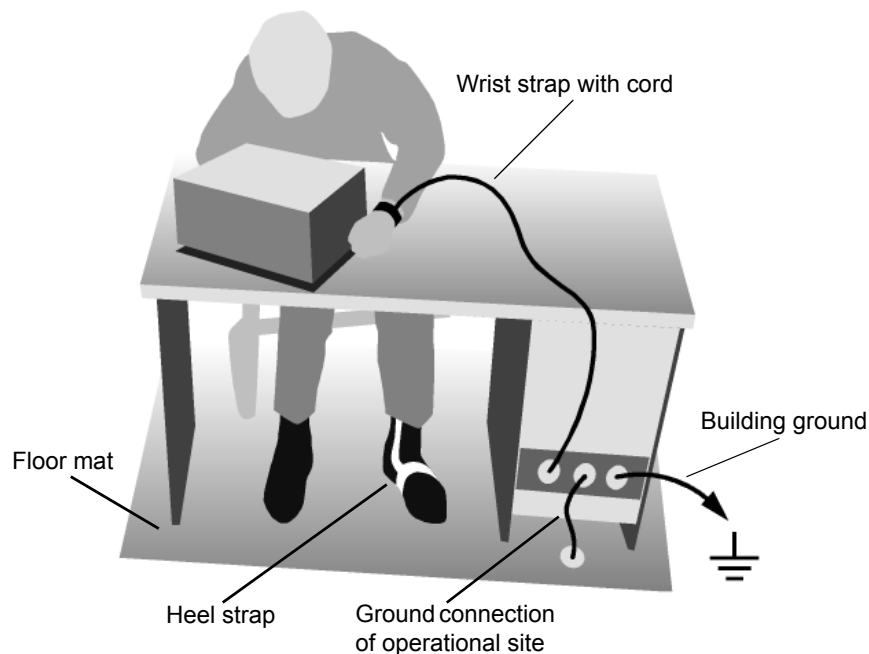
The instrument is intended for indoor use. Note the following in this regard:

- The ambient temperature must comply with the range specified in the data sheet.
- Air inflow and outflow via the air vents on the rear panel and through the lateral perforations must not be obstructed. Clearance from walls must be at least 10 cm.
- The mounting surface must be even.



Note

To protect DUTs against electrostatic discharge in the event of contact, use proper protective equipment:



Installation in a 19" Rack

The instrument can be installed in a 19" rack by using a rack adapter (see data sheet for order number). The installation instructions are included with the adapter.

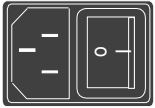


ATTENTION

When the instrument is installed in a rack, make sure that the vents for air inflow on the side panel and the air outlets on the rear panel are not obstructed.

Connecting the Instrument to the AC Power Supply

The R&S FMU is equipped with a mechanism for detecting AC power voltage and automatically sets itself to use the available AC power voltage (range: AC voltage 100 V to 240 V; 50 Hz to 400 Hz). The AC power connector is located on the rear panel of the instrument.



AC power connector

- Connect the R&S FMU to the AC power supply, using the power cable that is supplied.

Since the instrument is assembled in line with the specifications for safety class EN61010, it may only be connected to an outlet that has a ground contact.

Switching On the R&S FMU

- Press the power switch on the rear panel to change it to position I.
- Press the ON/STANDBY key on the front panel. The green LED will light up.



ATTENTION

Do not switch off the instrument while it is booting. Switching it off prematurely can lead to serious data changes on the instrument's hard disk.

After being switched on, the R&S FMU displays the following information:

```
Rohde & Schwarz GmbH & Co. KG
Analyzer BIOS      Vx.y
```

A self test of the computer hardware will be carried out. Windows XP then starts, and the measurement screen will automatically appear with the settings that were present when the instrument was last switched off.



Note

If you want the instrument to automatically load different settings when it is switched on, define the required configuration in the *FILE - STARTUP RECALL* menu.

Functional Test

**Note**

The functional test should only be performed when the operating temperature is reached (approx. 15 minutes after the instrument is switched on).

- Call self alignment with the *CAL* key, *CAL TOTAL* softkey. Once the system correction values have been calculated successfully, the message *Calibration Passed* will appear.
- Start the self test with the *SETUP* key, *SERVICE – SELFTEST* softkeys. Once the instrument modules have been checked successfully, the message *Selftest Passed* will appear.

Once both steps have been completed successfully, the instrument will be ready for operation.

**Note**

The self alignment does not need to be repeated every time the instrument is switched on, because the instrument saves the values and loads them during booting automatically. A self alignment is recommended if the instrument is used at a temperature that differs considerable (more than 10°C) from the temperature present at the last self alignment.

The self test also does not need to be repeated every time the instrument is switched on. It is necessary only when instrument malfunction is suspected.

Switching Off the R&S FMU

- Press the ON/STANDBY key on the front panel.

The R&S FMU will store the current settings on the hard disk and then shut down the software. Once the operation has been completed, the power supply unit will be switched to STANDBY and the yellow LED will come on.



DANGER

Danger of shock hazard

In standby mode, the AC supply voltage is still present on the instrument.

- To completely disconnect the instrument from the AC power supply, change the power switch on the rear panel to position O.



Note

- The main power switch on the rear panel also interrupts the power supply of the OCXO (optional) inside the instrument. When you switch the instrument back on, be sure to adhere to the extended warm-up phase.
 - If you switch off the instrument by using the power switch or by disconnecting the power supply connector, it is not possible to save the current instrument settings on the hard disk. In this case, the last settings that were stored on the hard disk will be loaded when you switch the instrument back on.
-

Cleaning the Outside

The outside of the instrument is suitably cleaned using a soft, line-free dust cloth. Make sure that the air vents are not obstructed.



ATTENTION

Instrument damage caused by cleaning agents

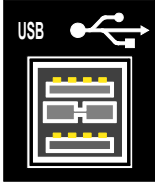
Cleaning agents contain substances that may damage the instrument, e.g. solvent-containing cleaning agents may damage the front panel labeling or plastic parts.

Never use cleaning agents such as solvents (thinners, acetone, etc.), acids, bases, or other substances.

Connecting External Devices

Connecting an External Keyboard

An external PC keyboard can be connected to the USB interface on the front or the rear panel of the R&S FMU.



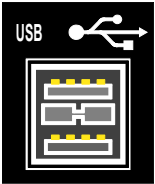
The keyboard simplifies instrument operation and the entry of comments, file names, etc.

Keyboards and mouse devices conform to USB Standards 1.1 or 2.0 are suitable for connection to the USB interface.

After being connected, the keyboard is automatically detected. The default keyboard language setting is US English. Special settings such as refresh rate, etc. can be made in the Windows XP Start menu by selecting *START - SETTINGS - CONTROL PANEL - KEYBOARD*.

Connecting a Mouse

To simplify Windows XP operation, the R&S FMU allows you to connect a mouse to one of the USB interfaces on the front or rear panel.



Mouse devices from Microsoft and Logitech are supported.



Note

If you use a keyboard that contains a trackball for mouse operations, connecting an external mouse in addition may lead to malfunctions.

After being connected, the mouse is automatically detected. Special settings such as mouse cursor speed, etc. can be made in the Windows XP Start menu by selecting *START - SETTINGS - CONTROL PANEL - MOUSE*.

Connecting an External Monitor



ATTENTION

Do not connect a monitor unless the instrument is switched off (STANDBY). Otherwise, you run the risk of damaging the monitor.

Do not change the screen driver (Display Type) or the screen configuration, as doing so can cause the instrument to malfunction.

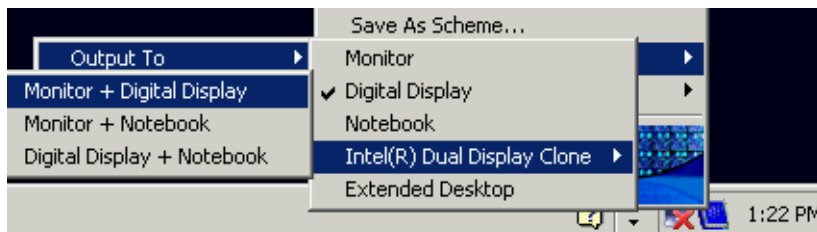
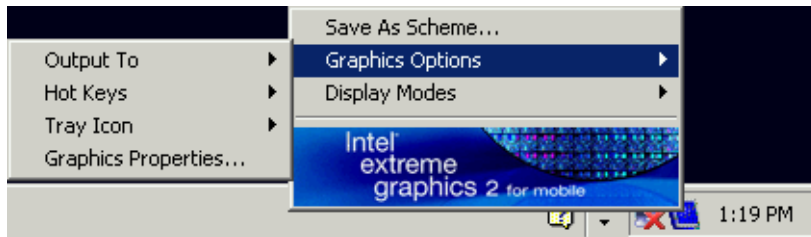
You can connect an external monitor at the MONITOR connector on the instrument's rear panel.



After connecting the external monitor, restart the instrument to detect the monitor. The measurement display will then appear on both the external screen and on the instrument. No further settings are necessary.

If the external monitor is not recognized by the instrument, you have to activate it. This requires a mouse and an external keyboard (the connection is described in sections “Connecting a Mouse” on page 2.8 and “Connecting an External Keyboard” on page 2.7).

- Make sure that the external monitor is connected.
- Press the *CTRL+ESC* key combination to display the taskbar.
- On the right side of the taskbar, click the monitor icon.
- Select *Graphics Options - Output To - Intel(R) Dual Display Clone - Monitor + Digital Display*.



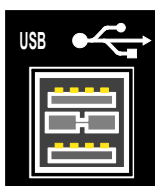
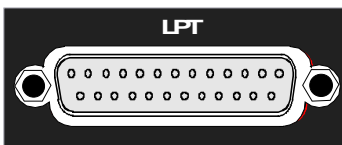
When the instrument is switched on later without a monitor, the activation of the external monitor is reset.

Connecting a Printer

A printer can be connected during operation.

The R&S FMU allows you to create two different printer configurations for printing out a hardcopy of the screen and you can toggle between them by pressing a button. The *DEVICES* table in the *HCOPY* menu lists the available installed printers.

The LPT printer interface is located on the rear panel. Alternatively, one of the USB interfaces can be used.



Connecting USB Devices (e.g. a Power Meter)

The USB interface on the front and the rear panel of the R&S FMU allows you to connect up to 4 USB devices directly to the R&S FMU. This number can be increased as necessary by inserting USB hubs.

Due to the large number of available USB devices, there is almost no limit to the expansions that are possible with the R&S FMU. The following list shows various USB devices that can be useful for the R&S FMU:

- Power sensors of the R&S NRP-Zxx series (require adapter cable R&S NRP-Z4)
- Memory stick for easy transfer of data to/from a PC (e.g. firmware updates)
- CD-ROM drives for easy installation of firmware applications
- PC keyboard for entering comments, file names, etc.
- Mouse for easy operation of Windows XP dialog boxes
- Printer for printing out measurement results
- Modem for remote control of the R&S FMU over large distances

Installing USB devices is easy under Windows XP, because all USB devices are plug&play. All USB devices can be connected to or disconnected from the R&S FMU during operation.

After a device is connected to the USB interface of the R&S FMU, Windows XP automatically searches for a suitable device driver.

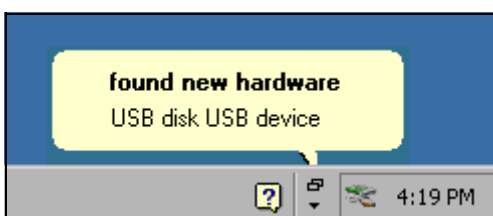
If Windows XP does not find a suitable driver, it will prompt you to specify a directory that contains the driver software. If the driver software is on a CD, connect a USB CD-ROM drive to the R&S FMU before proceeding.

When a USB device is subsequently disconnected from the R&S FMU, Windows XP immediately detects the change in hardware configuration and deactivates the corresponding driver.

Example:

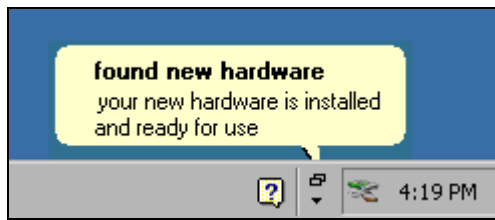
Connect a pendrive (memory stick) to the R&S FMU:

1. When you connect the pendrive at the USB interface, Windows XP detects the new hardware:

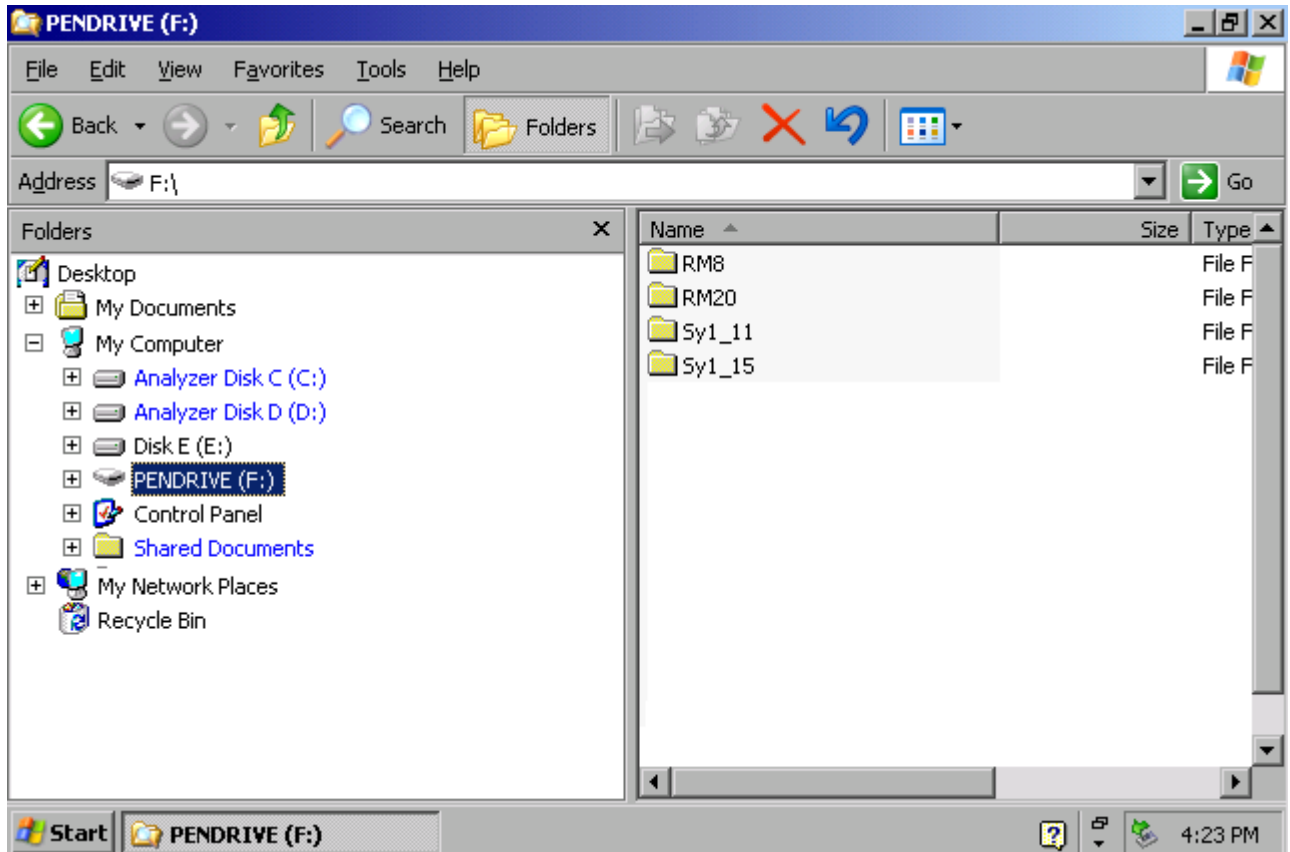


2. Windows XP installs the corresponding driver.

If installation is successful, Windows XP informs you that the device is ready to use:



3. The pendrive is made available as a new drive and is displayed in the Windows Explorer:



The pendrive can be used like a normal drive to load or store data.

4. If you no longer need the pendrive or if you want to transfer files to another computer, simply disconnect the pendrive. Windows XP will automatically deactivate the driver. If the drive is still selected in Explorer, an error message will appear indicating that the drive is no longer available.

Setup

Selecting the Frequency Reference

You can switch the reference signal for frequency processing of the R&S FMU between the internal reference and an external reference signal as follows:

- Press the *SETUP* key.
The *SETUP* menu will open.
- Press the *REFERENCE INT/EXT* softkey until it is in the desired state.
If *EXT* is selected, an entry field is displayed. By default, 10 MHz are set. You can vary the value in the range from 1 to 20 MHz.



Note

If the reference signal is missing when switchover to the external reference occurs, *EXREF* is displayed after a few moments, indicating that synchronization has not taken place.

EXREF is also displayed if the frequency of the reference signal does not comply with the frequency set.

When switchover to an internal reference occurs, note that the external reference signal is removed in order to avoid any interactions with the internal reference signal.

Remote command: `ROSC:SOUR INT`

Setting the Date and Time

- Press the *SETUP* key.
The *SETUP* menu will open.
- Press the *GENERAL SETUP* softkey.
The submenu with general settings will open.

The *TIME+DATE* softkey activates the *TIME AND DATE* table for entering the time and date for the internal real-time clock.

TIME AND DATE	
Time	12 : 30
Date	11 MAR 2002

Entering the time

Hours and minutes can be entered independently of each other in the entry field:

TIME	
TIME	12 : 30

Remote command: `SYST:TIME 12,30`

Entering the date

The day, month and year can be entered independently of each other in the entry field:

DATE			
DATE	11	Mar	2004

To select the month, use the units key to open a list containing the month names. You can then select the month from the list.

MONTH
JAN
FEB
✓MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Remote command: `SYST:DATE 2002,03,11`

Setting the GPIB Interface

- Press the *SETUP* key.
The *SETUP* menu will open.
- Press the *GENERAL SETUP* softkey.
The submenu with general settings will open.
- Press the *GPIB* softkey.
The submenu for setting the parameters of the remote control interface will open.

GPIB Address

- Press the *GPIB ADDRESS* softkey.
The entry field for the GPIB address will open.

The setting range is from 0 to 30. The default address is 20.

Remote command: `SYST:COMM:GPIB:ADDR 20`

ID Response String

- The *ID STRING FACTORY* softkey selects the default response to the command *IDN?.
Remote command: -
- The *ID STRING USER* softkey opens the editor for entering a user-defined response to the command *IDN?. The max. length of the output string is 36 characters.
Remote command: -

Setting the Screen Colors

- Press the *DISP* key.
The *DISPLAY* menu will open.
- Press the *CONFIG DISPLAY* softkey.
The submenu for configuring the screen will open.
- The *DEFAULT COLORS 1 and 2* softkeys set the default setting for brightness, tint and color saturation of all screen objects. The color schemes are selected in such a manner that all screen elements will be optimally visible regardless whether viewed from above or below. In the instrument's default setting, *DEFAULT COLORS 1* is active.

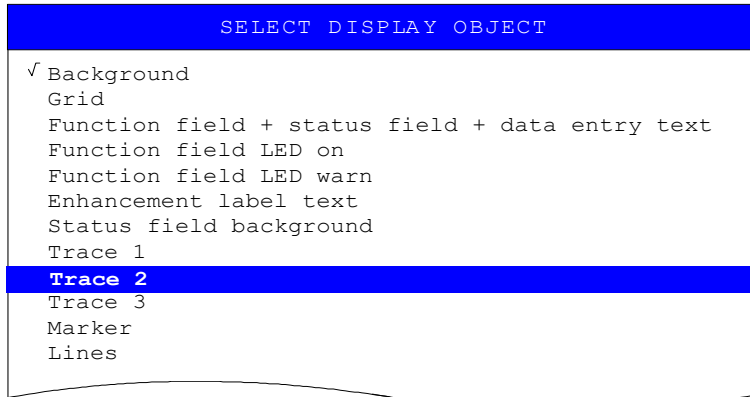
Remote command: `DISP:CMAP:DEF1`
`DISP:CMAP:DEF2`

The procedure for setting screen colors and brightness is as follows:

➤ Press the *NEXT* key.

The side menu for changing the screen colors will open.

The *SELECT OBJECT* softkey activates the selection of screen elements for which the color setting needs to be changed. Once this selection is made, the *PREDEFINED COLORS*, *BRIGHTNESS*, *TINT* and *SATURATION* softkeys can be used to change the overall color or the brightness, tint and color saturation of the selected element.



The *BRIGHTNESS* softkey activates entry of the brightness of the selected graphics element.

The entry value is between 0% and 100%.

Remote command: `DISP:CMAP5:HSL <hue>,<sat>,<lum>`

The *TINT* softkey activates entry of the tint for the selected graphics element. The percent value that is entered refers to a continuous color spectrum that ranges from red (0%) to blue (100%).

Remote command: `DISP:CMAP5:HSL <hue>,<sat>,<lum>`

The *SATURATION* softkey activates entry of the color saturation of the selected element.

The entry value is between 0% and 100%.

Remote command: `DISP:CMAP5:HSL <hue>,<sat>,<lum>`

➤ The *PREDEFINED COLORS* softkey opens a list for selecting predefined colors for the screen objects:



Remote command: `DISP:CMAP1 ... 26:PDEF <color>`

Automatically Switching Off the Internal Screen

The R&S FMU provides a feature for automatically switching off the screen after a user-defined period of time. The background lighting will be disabled if no entries are made from the front panel after the selected response time (key, softkey or hardkey and rotary knob).

To activate automatic switch-off:

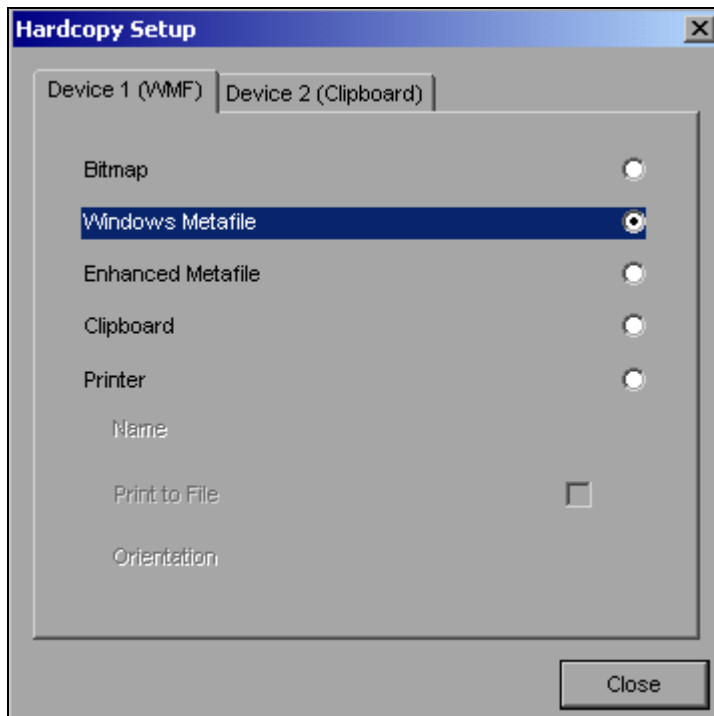
- Press the *DISP* key.
- Press the *CONFIG DISPLAY* softkey.
- Press the *DISPLAY PWR SAVE* softkey.
The softkey will have a color background, indicating that the power save mode is active. At the same time, the input window for the response time will open.
- Enter the desired response time in minutes and confirm the entry with the *ENTER* key.
The screen will be disabled (turn dark) after the selected period of time.

To deactivate automatic switch-off:

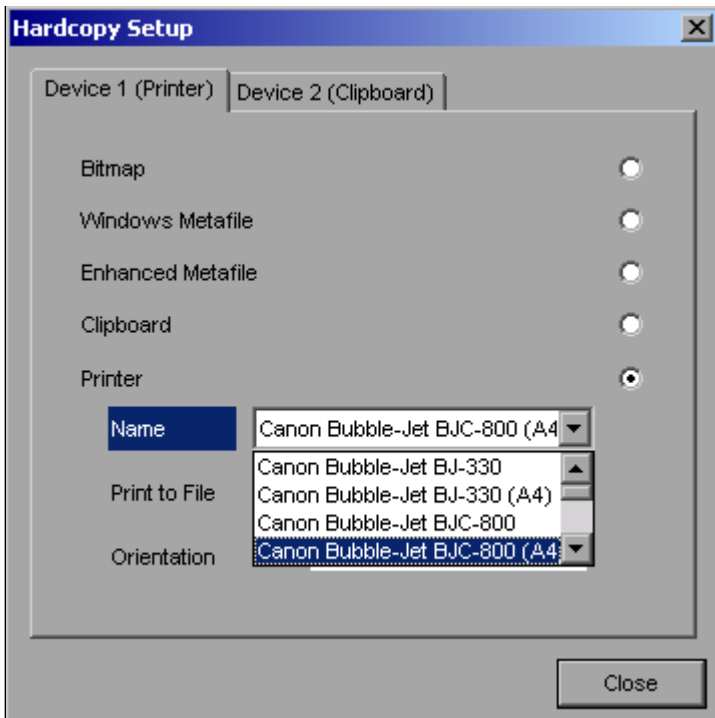
- Press the *DISP* key.
- Press the *CONFIG DISPLAY* softkey.
- Press the *DISPLAY PWR SAVE* softkey twice.
The color background of the softkey will disappear.
The power save mode is now switched off.

Selecting and Configuring Printers

- Press the *HCOPY* key.
The *HARDCOPY* menu will open.
- Press the *DEVICE SETUP* softkey.
The dialog box for selecting the file format and printer will open:



- You can select a connected printer (including a pre-configured network printer) by positioning the selection bar on the *Printer* entry by turning the rotary knob and then confirming the selection by pressing the rotary knob or the *ENTER* key.
After you confirm the selection, the entries *Name*, *Print to File* and *Orientation* will be made available and can also be accessed with the rotary knob.
- To select the printer type, open the selection list by pressing the rotary knob or the *ENTER* key after you access the *Name* field.

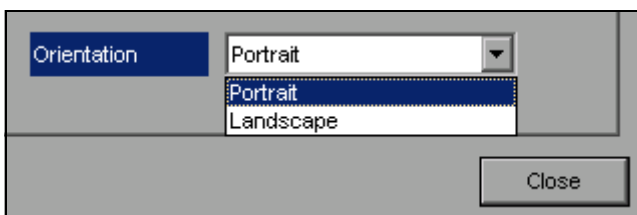


From the selection list, you can now select the printer you want (in the example, this is *Canon Bubble-Jet BJC800 (A4)*) by using the rotary knob again and then confirming your selection with *ENTER* or by pressing the rotary knob. The selection list will then disappear and the entry cursor will return to the *Name* field.

- You can also redirect the output to a file rather than to a printer. To do this, select the field *Print to File* by using the rotary knob and then mark the appropriate selection box or cancel the marking by pressing either the rotary knob or the *ENTER* key:



- You can select orientation for paper printout by using the *Orientation* field. To open the selection list, press the rotary knob or *ENTER*:



From the selection list, you can now select the orientation you want (*Portrait* in the preceding figure) by using the rotary knob again and then confirm with *ENTER* or by pressing the rotary knob. The selection list will then close and the entry cursor will return to the *Orientation* field.

You can now close the dialog box by pressing the *ESC* key or by selecting and confirming the *Close* button.

Selecting Alternative Printer Configurations

The R&S FMU can support two independent hardcopy settings. This allows you to quickly switch between output to a file and a printer.

- To make a selection, use the *DEVICE 1 / 2* softkey, which simultaneously shows the associated setting when the *Hardcopy Setup* dialog box is open.

Remote command: -

Selecting Printer Colors

- The *COLORS* softkey opens the submenu for selecting the colors for the printout. To make it easier for you to select colors, the selected hardcopy color combination is displayed on screen when you access the menu. When you exit the menu, the system switches back to the previous color combination.
- The *COLOR ON OFF* softkey switches from color output to black-and-white printout. In this case, all background colors will be printed out in white and all color lines in black. This allows you to improve contrast on the printout. The basic setting is *COLOR ON*.

Remote command: `HCOP:DEV:COL ON`

- The *SCREEN COLORS* softkey selects the current screen colors for the printout.



Note

The background will always be printed out in white and the grid in black.

Remote command: `HCOP:CMAP:DEF1`

- The *OPTIMIZED COLORS* softkey selects an optimized color setting for the printout in order to improve color clarity on the printout.

With this selection, trace 1 will be printed out in blue, trace 2 in black, trace 3 in green and the markers in turquoise.

The other colors correspond to the screen colors of the *DISP – CONFIG DISPLAY - DEFAULT COLORS 1* softkey.



Note

The background will always be printed out in white and the grid in black.

Remote command: `HCOP:CMAP:DEF2`

- The *USER DEFINED* softkey opens a submenu for user-defined color selection (see the *USER DEFINED COLORS* submenu).

The procedure for making the settings is similar to that for setting the screen colors.

Remote command: `HCOP:CMAP:DEF3`

Installing Plug&Play Printers

Plug&play printers can easily be installed under Windows XP:

After you connect and switch on a printer, Windows XP automatically detects the printer and installs the associated driver, provided that the driver is contained in the Windows XP installation.

If Windows XP does not find the printer driver, it will prompt you to enter a path for the associated installation files. In addition to the pre-installed drivers, a number of additional printer drivers are found in the D:\I386 directory.



Note

When you install printer drivers that are not pre-installed on the instrument, the installation process will prompt you to specify the path containing the new driver. This can be a memory stick or USB CD-ROM drive (see the section [“Connecting USB Devices \(e.g. a Power Meter\)”](#) on page 2.10).

Installing Non-Plug&Play Printers

The procedure for installing non-plug&play printers is described in appendix [A](#), section [“Installing Non-Plug&Play Printers”](#) on page A.1.

Configuring the LAN Interface

The instrument can be connected to an Ethernet LAN (local area network) using the LAN interface connector on the rear panel. This makes it possible to transfer data over the network and to use network printers. In addition, the instrument can be remote-controlled via the network. The network card can be operated with a 10 MHz Ethernet IEEE 802.3 or a 100 MHz Ethernet IEEE 802.3u interface.

Connecting the Instrument to the Network



ATTENTION

Before connecting the instrument to the network, consult your network administrator, particularly in the case of large LAN installations. Connection errors may affect the entire network.

Connect a conventional RJ-45 cable (not supplied) to the rear panel of the instrument and a network hub of the required LAN segment. Since the RJ-45 involves star configuration rather than bus cabling, no special measures need to be taken.



Setting up the connection does not cause any problems on the network. Likewise, disconnecting the instrument from the network does not cause any problems as long as no data traffic to and from the instrument is in progress.

Configuring the Network Card

Driver Installation

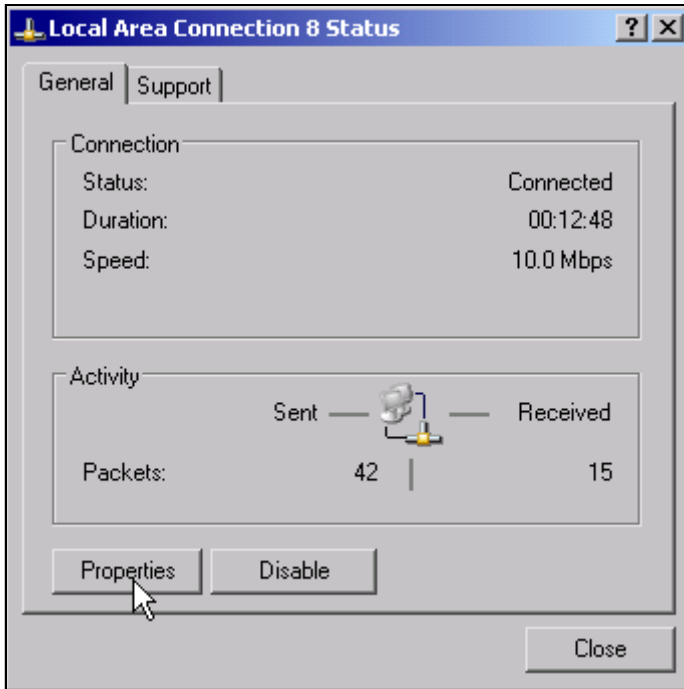
Under Windows XP, network card drivers do not need to be installed separately.

All you need to do is connect the network cable to the LAN-Interface connector on the instrument rear panel. Windows XP automatically detects the network connection and activates the required drivers.

Configuring the Interface

To configure the interface, do the following:

- Press the SETUP key.
The SETUP menu will open.
- Press the GENERAL SETUP softkey.
The submenu with all general settings will open.
- Press the *CONFIGURE NETWORK* softkey.
The dialog box with the network settings will open.



This softkey allows you to change the existing network configuration depending on the selection of the affected registration cards (see section "[Configuring Existing Network Protocols \(TCP/IP Protocol\)](#)" on page 2.23).

Remote command: -



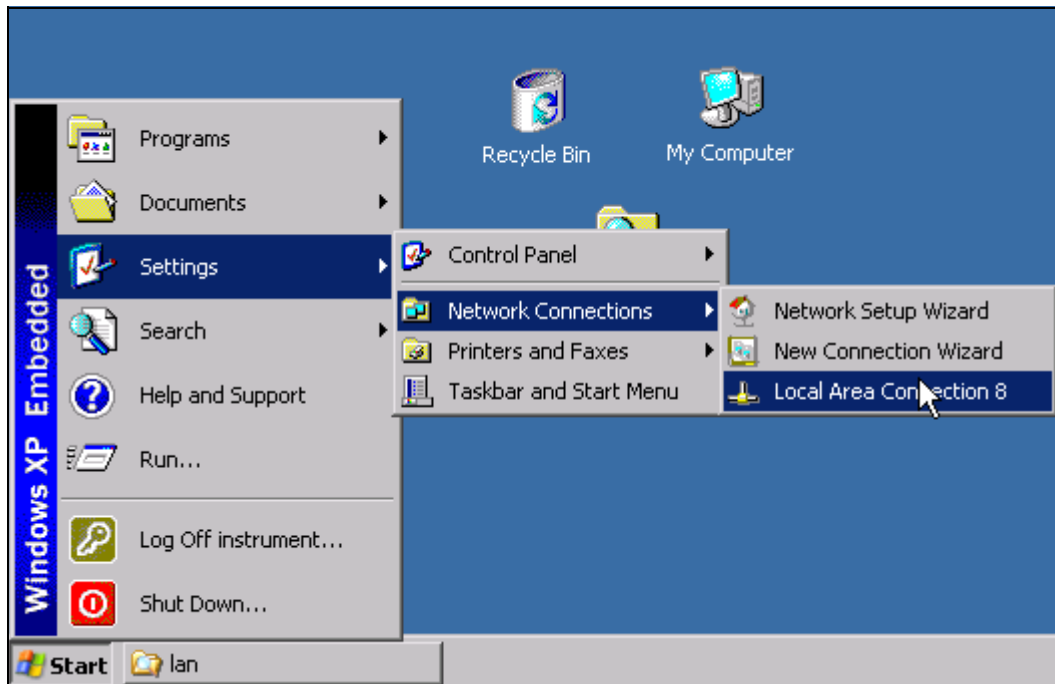
Note

Before you can configure network support, a PC keyboard with a trackball (or an additional mouse rather than a trackball) must be connected.

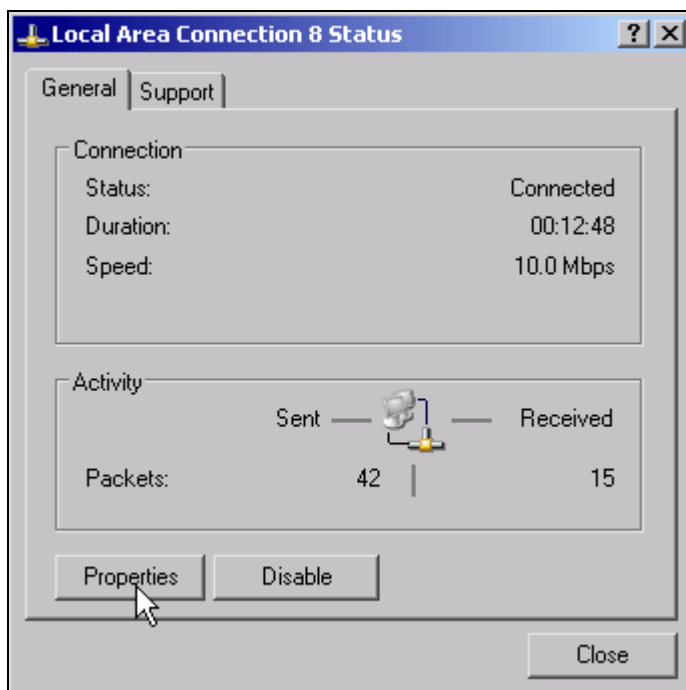
Configuring Existing Network Protocols (TCP/IP Protocol)

When you receive the instrument, the TCP/IP network protocol is already pre-installed with IP address 10.0.0.10 and subnet mask 255.255.255.0. The steps that are necessary in order to change this configuration and install additional network protocols are described in this and the following sections.

- Open the Windows XP Start menu by pressing the Windows key or *CTRL+ESC*.
- Click *Settings - Network Connections - Local Area Connection*.



The *Local Area Connection Status* dialog box will open.

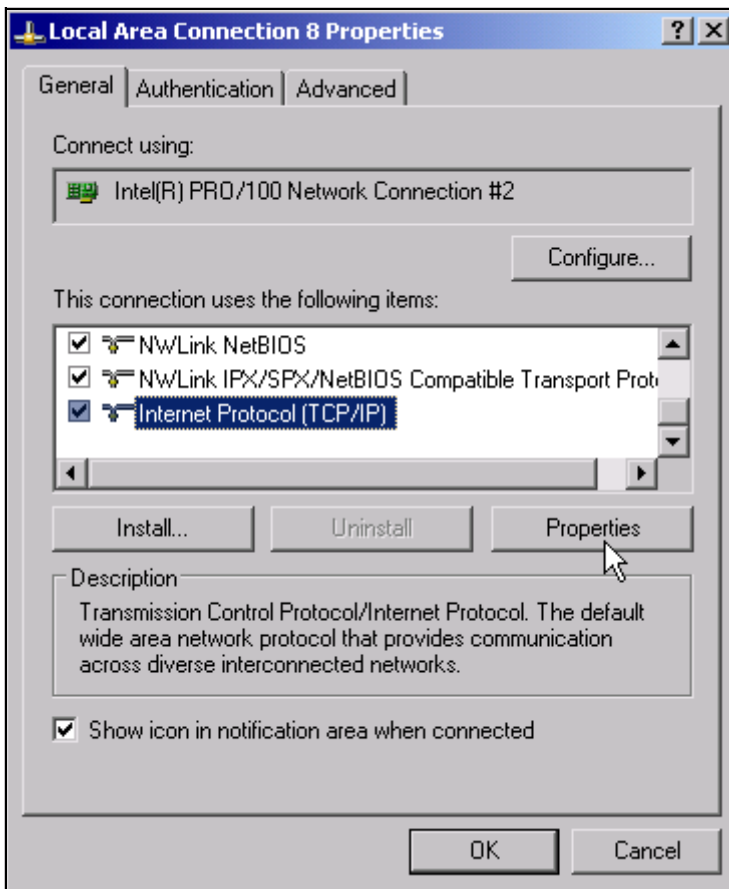




Note

Windows XP automatically appends numbers to the name Local Area Connection Status (e.g. Local Area Connection Status 8) if the configuration is set up using the New Connection wizard. These numbers are not important in the following configuration steps and are therefore omitted.

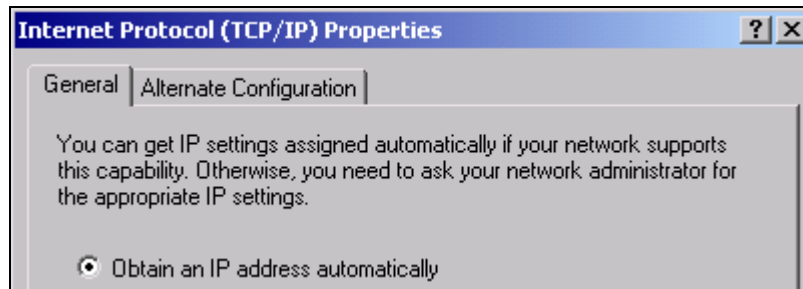
- Click the *Properties* button.
The window with the available network protocols will open.



- Click the network protocol you want (TCP/IP in the example).

- Click the *Properties* button.

The dialog box with the settings for the selected network protocol will open.



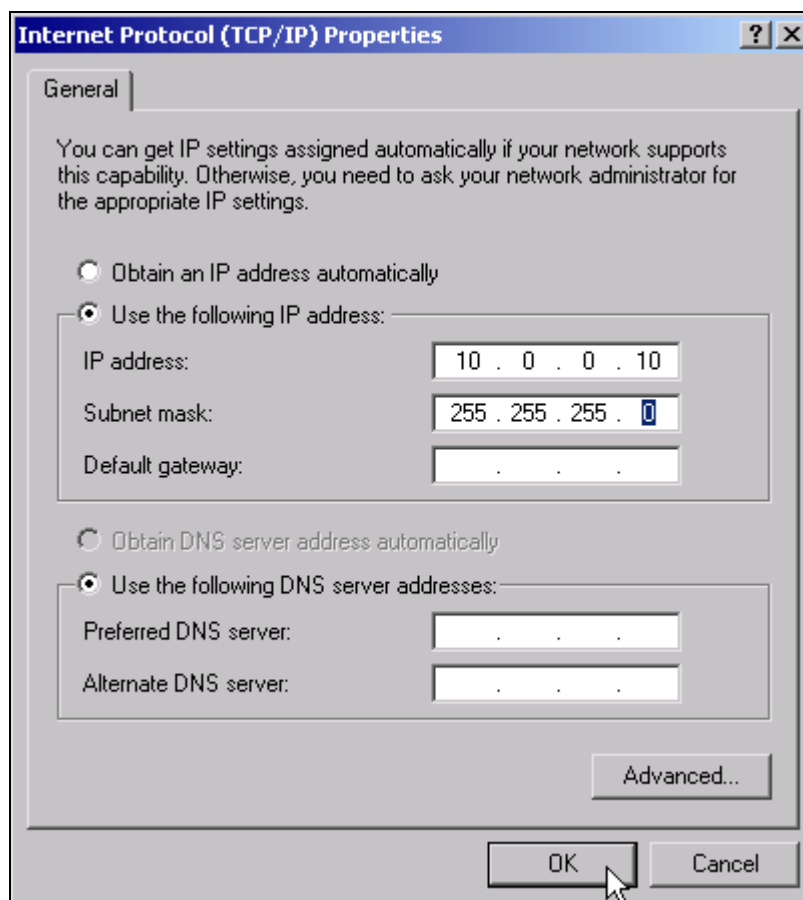
If the IP address will automatically be requested from a DHCP server, select *Obtain an IP address automatically*.



Note

Your network administrator will know whether your network has a DHCP server.

- Click *OK*. Windows XP will store the configuration.
- If you want to enter a predefined IP address (because, for example, the network does not have a DHCP server), select *Use the following IP address*.



- Select *IP address* and enter the IP address.

- Select *Subnet mask* and enter the required mask.

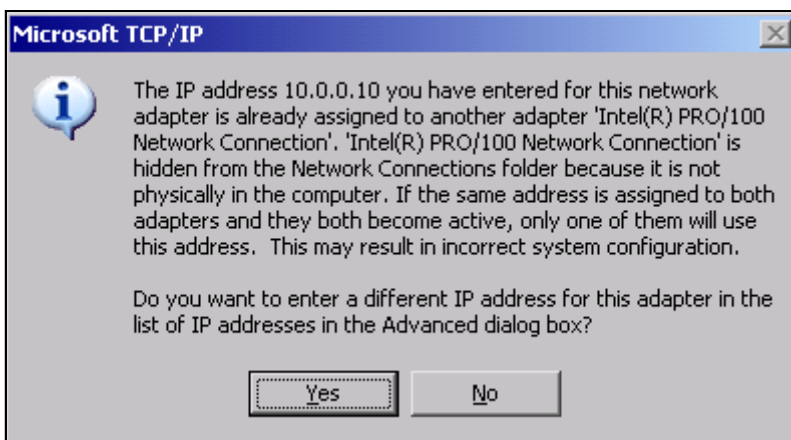


Note

Your network administrator will know which IP addresses and subnet masks are suitable for your network.

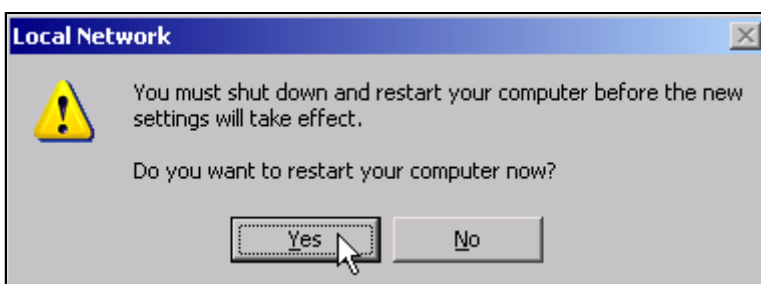
- Click *OK*.
Windows XP will check the entered settings for correctness and then store the configuration.

If you have entered an invalid IP address or subnet mask, an error message will appear that also asks you whether you want to enter a different address or mask:



- Click *Yes*.
The dialog box for entering the TCP/IP parameters will open again.

If all settings are correct, you will be prompted to restart the instrument if required by the changes.



- Click *Yes*.
Windows XP will restart the system.

Installing Additional Network Protocols and Services

The procedure for installing additional network protocols and services is provided in the chapter “[LAN Interface](#)”.

Login

Windows XP requires that users identify themselves by entering a user name and password in a login window. The instrument provides a factory-installed auto login function, i.e. login is carried out automatically in the background. The ID used for auto login has administrator rights. As user name and password *instrument* (lowercase) are set.

For information on how to deactivate the automatic login, refer to chapter “[LAN Interface](#)”, section “[Deactivating the Automatic Login Mechanism](#)” on page 6.16.

Operating System Properties

Properties Specific to Windows XP

The instrument contains the Windows XP operating system. To ensure that the instrument software functions properly, certain rules must be adhered to when using the operating system.



ATTENTION

The drivers and programs used in the instrument under Windows XP have been adapted to the instrument. To avoid impairments to instrument function, use only the settings described in the Operating Manual and this manual.

Only update software approved by Rohde & Schwarz may be used to modify existing instrument software.

Likewise, only programs approved by Rohde & Schwarz for use on the instrument may be run on the instrument.

Login

For details refer to section “[Login](#)” on page 2.27.

Administrator ID

The ID used by the instrument to perform auto login has administrator rights.

Windows XP Service Packs


The Windows XP operating system on the instrument is supplied with pre-installed XP service packs (SP2 and additional updates/fixes) that are necessary and suitable for operating the instrument.



ATTENTION

To prevent malfunctions, only service packs approved by Rohde & Schwarz may be loaded on the instrument. Malfunctions may necessitate instrument repair in worst cases.

Opening the Windows XP Start Menu

You can open the Windows XP Start menu by pressing the Windows key () or the key combination *CTRL+ESC*. From the start menu, you can navigate to the submenus by using the mouse or the arrow keys. To return to the measurement screen, activate the *R&S Analyzer Interface* button in the task bar.

Windows XP Software Approved for the Instrument

The driver software that is used and the system settings of Windows XP have been fine-tuned to support the measurement functions of the R&S FMU. Thus, flawless instrument function is ensured only if software and hardware approved or offered by Rohde & Schwarz are used.

Using other software or hardware may cause the functions of the R&S FMU to perform improperly or fail.

The following program packages have been successfully tested for compatibility with the measurement instrument software:

- Windows XP Remote Desktop
- FileShredder – For reliable deletion of files on the hard disk
- Symantec Norton AntiVirus – Virus-protection software
- McAfee Virusscan

3 Firmware Update and Installation of Firmware Options

Firmware Update

You can install a new firmware version by using a memory stick, a USB CD-ROM, or LAN. The firmware update kit contains several disks whose contents must be stored in separate directories (Disk1 to Disk<n>) when a memory stick or LAN is used. Start the installation program from the *SETUP* menu.

- Press the *SETUP* key.
The *SETUP* menu will open.
- Press the *NEXT* key.
The side menu will open.
- Press the *FIRMWARE UPDATE* softkey.
The subdirectory for installing or uninstalling new firmware versions will open.
- Press the *UPDATE PATH* softkey. The entry field for the path with the set of update directories will open.
- Enter the drive name and directory and confirm with *ENTER*.

Example:

The firmware update files are stored on a memory stick in the *Update* directory. They are allocated in the *Disk1* to *Disk<n>* subdirectories. After you insert the memory stick, it will be detected as drive *E:*.

In this case, the required path specification is *E:\UPDATE*.

- To start the installation program, press the *FIRMWARE UPDATE* softkey in the submenu. The installation program will then guide you through the remainder of the update procedure.

Remote command: `"SYST:FIRM:UPD 'E:\UPDATE'"`

- To restore the previous firmware version, press the *RESTORE FIRMWARE* softkey.

Remote command: `--`

Activating Firmware Options

Firmware options are enabled by entering license keys via the following operating sequence:

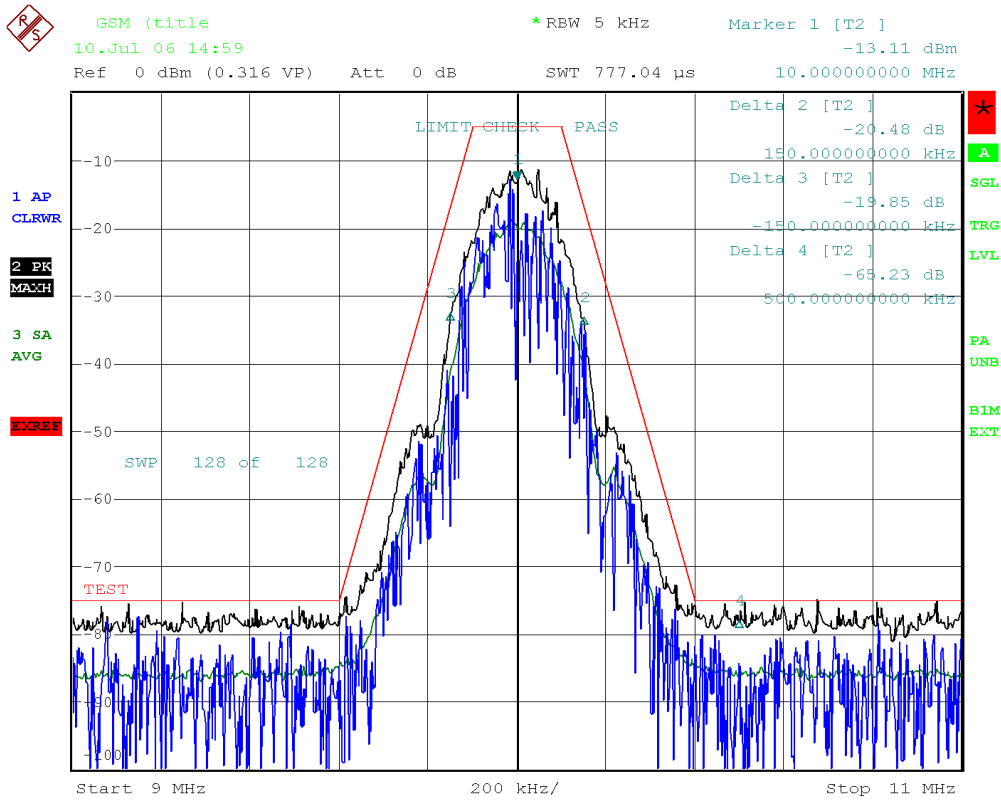
- Press the *SETUP* key.
The *SETUP* menu will open.
- Press the *GENERAL SETUP* softkey.
- Press the *OPTIONS* softkey.
The *OPTIONS* menu will open. Options already available are listed in a table that is displayed when the submenu is opened.

FIRMWARE OPTIONS		
DESCRIPTION	NAME	CODE
GSM/EDGE Application V1.05	K5	4074151143
FM Demodulator	K7	3414471008

- Press the *INSTALL OPTION* softkey.
The field for entering the license key for the firmware option now appears.
After you enter a valid license key, *OPTION KEY OK* will appear in the message line and the option will be entered in the *FIRMWARE OPTIONS* table.
If you enter an invalid license key, the message *OPTION KEY INVALID* will appear in the message line.
- The *REMOVE OPTION* softkey deletes all existing firmware options. To prevent unintentional deletion, the system asks you to confirm that you really want to perform this operation.

4 Basic Operation

Diagram Layout



This is a screen title
 Date: 10.JUL.2006 14:59:15

Fig. 4-1 Screen layout of the R&S FMU during FFT operation

Displays in the Diagram Area

Hardware settings

Ref	Display of the reference level.
Offset	Display of the reference level offset.
Att	Display of the attenuation that has been set.
RBW	Display of the resolution bandwidth that has been set. If the bandwidth does not correspond to the value for automatic coupling, a green asterisk "*" will appear in front of the field.
SWT /	In the time domain, display of the sweep time (<i>SWEEP TIME</i>) that has been set.
AQT	In the frequency domain, display of the acquisition time of the captured IQ data.
Marker /	Contains the x and y axis positions of the last marker or delta marker that was set as well as its index. The value in the square brackets after the index indicates the trace to which the marker is assigned as well as the active measurement function. The measurement functions of the markers are indicated with the following abbreviations:
Delta	
	<ul style="list-style-type: none">• FXD Reference fixed marker active• PHN Phase noise measurement active• NOI Noise measurement active• MOD Measurement of the AM modulation depth active
LIMIT	Display of the results of the limit check.
CHECK	

Status displays

The status displays on the left side of the diagram indicate any irregularities (e.g. UNCAL).

UNCAL Indicates that one of the following conditions is present:

- Correction data has been switched off (*CAL* menu, *CAL CORR OFF*).
 - Switch on the correction *CAL CORR ON* or *PRESET*.
- No valid correction values are available. This occurs, for example, if a firmware update is performed followed by a cold start of the instrument.
 - Record the correction data (*CAL* menu, *CAL TOTAL*).

OVLD Indicates an overload of the baseband signal path.

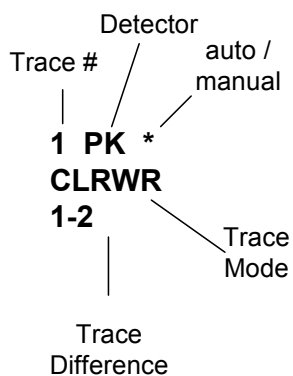
- Increase the reference level.

CLUNL Indicates that an error was detected in the instrument's frequency processing hardware.

EXREF Is displayed if the instrument was set to an external reference but no signal was detected on the reference input.

OVEN Indicates that the OCXO reference frequency (option R&S FSU-B4) has not yet reached its operating temperature. The message usually disappears a few minutes after power-on.

Trace information

**Trace #**

Trace number (1 to 3)

Detector

Selected detector:

- AP: AUTOPEAK detector
- PK: MAX PEAK detector
- MI: MIN PEAK detector
- SA: SAMPLE detector
- AV: AVERAGE detector
- RM: RMS detector

auto /manual

The selected detector does not match the one for automatic coupling.

Trace Mode

Display of the sweep mode:

- CLRWR: CLEAR/WRITE
- MAXH: MAX HOLD
- MINH: MIN HOLD
- AVG: AVERAGE
- VIEW: VIEW

Trace Mathematics

Indicates that the trace difference function is activated.

- 1 - 2: Trace 1 - Trace 2
- 1 - 3: Trace 1 - Trace 3

Enhancement labels:

The enhancement labels on the right-hand side of the measurement diagram indicate that the user chose instrument settings that affect the measurement results even though this is not immediately apparent from the display of the measured values.

- * (star) The current instrument setting does not match the one during which the displayed traces were recorded. This occurs in the following cases:
- The instrument setting is changed while a measurement is in progress.
 - The instrument setting is changed in the SINGLE SWEEP mode after the end of the sweep, and a new sweep is not started.
 - The instrument setting is changed after a trace has been set to VIEW.

The display remains on screen until the user eliminates the cause. In some cases, this involves starting a new sweep (SINGLE SWEEP mode) or switching the affected trace to BLANK.

A/B	Designation for screen A/B. If screen A/B is activated for entering measurement parameters, the label background will be in color.
SGL	The sweep is set to SINGLE SWEEP.
TRG	Instrument triggering is not free running (\neq FREE RUN).
LVL	A level offset \neq 0 dB is set.
FRQ	A frequency offset \neq 0 Hz is set.
PRN	Printer output is active.
EXT	The instrument is configured for operation with an external reference.
PS	The PRESELECTOR is switched on.
B50	50 Ω input resistance at the baseband input.
B1M	1 M Ω input resistance at the baseband input.
BAL	Baseband input balanced (differential).
UNB	Baseband input unbalanced (single ended).

Setting Parameters

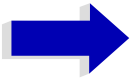
The Keypad



The keypad is used to enter numeric parameters. It contains the following keys:

- Numeric keys 0...9
- Decimal point
Inserts a decimal point "." at the cursor position.
- Sign key
Changes the sign of a numeric parameter.
In the case of an alphanumeric parameter, inserts a "-" at the cursor position.
- Unit keys (*GHz/dBm MHz/dBm, kHz/dB and Hz/dB*)
These keys add the selected unit to the entered numeric value and complete the entry.
In the case of level entries (e.g. in dB) or dimensionless values, all units have the value "1" as multiplying factor. Thus, they have the same function as an *ENTER* key. The same is true for an alphanumeric entry.
In addition, the unit keys open and close selection fields in tables (subtables).
- *BACK* key
 - If a numeric entry has already been started, this key deletes the character to the left of the cursor.
 - If an entry has been completed or not yet started, this key toggles between the currently and previously valid value (UNDO function).
- *ESC/CANCEL* key
 - Closes the entry field if an entry has been started or has not yet been made. The original value is retained.
 - Closes the entry field if an entry has been completed.
 - Closes the *System Messages* dialog box.

- *ENTER* key
 - Concludes dimensionless entries. The new value is accepted.

**Note**

With frequency entries, the *ENTER* key corresponds to the *Hz* key. With time data, it corresponds to the μ s (kHz) key.

The Rotary Knob and Arrow Keys


The rotary knob and arrow keys are located next to the keypad.



The rotary knob has several functions:

- Increments (clockwise direction) or decrements (counterclockwise direction) the instrument parameter at a defined step width in the case of a numeric entry.
- Shifts the selection bar horizontally or vertically within tables as long as an entry field is not open. The arrow keys are used to change the direction of motion (horizontal/vertical).
- Selects the individual letters when the alphanumeric editor is used.
- Shifts markers, limit lines, etc. on the screen.
- When it is pressed, it concludes an entry.

Within a table, the arrow keys move the selection bar to the desired position.

Within the alphanumeric editor, the  or  arrow keys move the cursor to the desired position.

The  or  arrow keys do the following:

- Increase or decrease the instrument parameter in the case of numeric entries.
- Switch between the editing line and the character selection in the case of alphanumeric entries.



Editing Numeric Parameters

Numeric values are always entered in a data entry field that automatically appears after the parameter is selected.

START FREQUENCY	Title line with parameter designation
10.2457535 GHz	Editing line with parameter value and unit
START FREQUENCY OUT OF RANGE	Status and error messages



The title line shows the name of the instrument parameter that was selected. The entry is performed in the editing line. After the entry field is opened, it will contain the currently valid parameter value and its unit. The optional third and fourth lines show status and error messages which always refer to the current entry.

Editing Alphanumeric Parameters




If an external keyboard is not available, the character selection field is automatically opened for entering alphanumeric parameters. Two models of the alphanumeric editor are available.

Alphanumeric Editor Type 1:




CALIBRATION FILE	
C:\MEASDATA\STANDARD.CAL	Entry (editing) line
	Message line
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z Ä Ö Ü ! ? " \$ % / () { [] \ + * # ~ ^ ' - = . : a b c d e f g h i j k l m n o p q r s t u v w x y z ä ö ü ß , ; < > @ p ² ³ ^ ° 1 2 3 4 5 6 7 8 9 0	Character selection line

The  or  arrow keys switch between the editing line and the character selection field.


Entering the text

- Select the parameter.
Data entry is automatically activated after the data entry field is opened. The cursor is now located at the start of the previous entry in the editing line.
- Using the  arrow key, place the cursor in the character selection field.
The cursor now marks the first letter of the editor.
- Using the  and  arrow keys or the rotary knob, place the cursor on the character that you want to enter in the editing line.
- Press either the *ENTER* key or the rotary knob.
The character will be added to the editing line.

Correcting the entry

- Using the  arrow key, place the cursor in the editing line.
- Using the  and  arrow keys or the rotary knob, place the cursor after the character you want to delete.
- Press the *BACK* key.
The entry to the left of the cursor will be deleted.

Correcting the entry

- Using the  key, place the cursor in the editing line.
- Press one of the unit keys or the rotary knob.
The data entry field will close, and the new entry will be accepted by the instrument.

Cancelling the entry

- Press the *ESC* key.
The data entry field will close, and the previous entry will be retained.

Alphanumeric Editor Type 2:





A	B	C	D	E	F	G	H	I	J	K	L	M	1	2	3	4	5	6	7	8	9	0
ll	o	p	q	r	s	t	u	v	w	x	y	z	:	\	.	/	^	+	-	=		,
a	b	c	d	e	f	g	h	i	j	k	l	m	<	>	()	{	}	[]	#	~
n	o	p	q	r	s	t	u	v	w	x	y	z	'	@	;		?	!	"	€	\$	%
SPACE													«	»	BACK				EXIT			

The entry area consists of two parts:

- The editing line
- The character selection field

The  or arrow keys switch between the editing line and the character selection field.




Entering the text

- Select a parameter.
Data entry is automatically activated after the data entry field is opened. In tables, the character selection field is accessed by using the  arrow key.
The cursor is now located at the start of the existing entry in the editing line.
- Using the  arrow key, place the cursor in the character selection field.
The cursor now marks the first character of the editor.
- Using the  and  arrow keys or the rotary knob, place the cursor on the character that you want to enter in the editing line.
- Press the *ENTER* key or the rotary knob.
The character will be added to the editing line.

Correcting the entry (alternative 1)

- Using the rotary knob, go to the << character in the character selection field.
- By pressing the rotary knob on << and >>, place the cursor after the character you want to delete.
- Using the rotary knob, select the BACK field and press the rotary knob.
The entry to the left of the cursor in the editing line will be deleted.


Correcting the entry (alternative 2)

- Using the  arrow key, place the cursor in the editing line.
- Using the  and  arrow keys or the rotary knob, place the cursor after the character you want to delete.
- Press the *BACK* key.
The entry to the left of the cursor will be deleted.

Completing the entry (alternative 1)

- Using the rotary knob, select the EXIT field and then press the rotary knob.
The data entry field will close, and the new entry will be accepted by the instrument.

Completing the entry (alternative 2)

- Using the  arrow key, place the cursor by the editing line.
- Press one of the unit keys or the rotary knob.
The data entry field will close, and the new entry will be accepted by the instrument.

Cancelling the entry

- Press the *ESC* key.
The data entry field will close, and the previous entry will be retained.

5 Basic Measurement Examples

This section provides a brief introduction on operating the R&S FMU Baseband Signal Analyzer. A more detailed discussion of the basic operating steps, e.g. selecting menus and setting parameters, plus measurement examples are provided in the Operating Manual, chapters 2 and 4.

Introduction

The R&S FMU has the ability to measure both complex and real signals.

For complex signals, connect the real part to the I input and the imaginary part to the Q input. For real signals, you can use both inputs.

The setting for real or complex signals is as follows:

1. Press the *FFT HOME* hotkey.
2. Press the *SIGNAL SOURCE* softkey.
3. Press the *I/Q PATH* softkey.
4. Define the input and the signal type:
 - Press the *I ONLY* softkey.
For real signals, use the I input.
 - Press the *Q ONLY* softkey.
For real signals, use the Q input.
 - Press the *I +j*Q* softkey.

For complex signals, use the I input for the real part and the Q input for the imaginary part.

The current setting is recognized easily: it is indicated at each active input by a luminous LED.

In the *PRESET* setting, the R&S FMU is configured for complex signals.

In the setting for real signals, the R&S FMU works like a normal spectrum analyzer. Because of the more simple signal generation, most of the following measurement examples use real signals.



Note

If the R&S FMU is configured for real signals (*I ONLY*, *Q ONLY* softkeys), only positive frequencies are displayed and the level of the real signal is indicated correctly.

If the R&S FMU is configured for complex signals (*I +j*Q* softkey), but a real signal is connected to the I or Q input, the spectrum of the signal is splitted into positive and negative frequencies. A sinusoidal signal is therefore displayed at positive and negative frequencies, where the indicated level of both spectral lines equals the level of the present signal (- 3.01 dB).

Measuring a Sinusoidal Signal

One of the most common measurement tasks is determining the level and frequency of a signal.

**Note**

If levels higher than +30 dBm (=1 W) are expected or are possible, a power attenuator must be inserted before the baseband input of the R&S FMU. If this is not done, signal levels exceeding 30 dBm can damage the internal attenuator or the input amplifier. The total power of all signals that are present must be taken into account.

If the input impedance is set to 1 M Ω , the maximum safe input voltage is ± 5 V. If you expect higher voltages, use a probe (High Impedance Probe) with a suitable factor (e.g. 10:1).

In the following examples, a signal generator is used as a signal source.

Test setup:

Connect the output of the signal generator to the I input of R&S FMU.

Settings on the signal generator:

Frequency: 10 MHz
Level: -10 dBm

Measuring the Level and Frequency with Markers

The level and frequency of a sinusoidal signal can be measured easily by using the marker function. The R&S FMU always displays its amplitude and frequency at the marker position. The frequency measurement uncertainty is determined by the reference frequency of the R&S FMU, the resolution of the marker frequency display and the resolution of the screen.

Procedure

1. Reset the instrument.

- Press the *PRESET* key.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Setup the instrument for real signals.

- Press the *SIGNAL SOURCE* softkey.
- Press the *IQ PATH* softkey.
- Press the *I ONLY* softkey.

4. Connect the signal to be measured to the I INPUT input on the instrument front panel.

5. Set the center frequency to 10 MHz.

- Press the *FREQ* key.
The entry field for the center frequency appears on screen.
- Using the numeric keypad in the input field, enter *10* and confirm the entry with the *MHz* key.

6. Reduce the frequency span (SPAN) to 1 MHz.

- Press the *SPAN* key.
- Using the numeric keypad in the input field, enter *1* and confirm the entry with the *MHz* key.



Note

When the frequency span is defined, the resolution bandwidth (*RES BW*), are automatically reset, because this function is linked in the preset setting.

7. Measure the level and frequency using the marker and read the results from the screen.

- Press the *MKR* key.
The marker is activated and automatically jumps to the maximum of the trace.

**Note**

When a marker is initially activated, it automatically performs the peak search function (as shown in the example).

If a marker is already active, press the *PEAK* key in the *MKR->* menu in order to set the currently active marker to the maximum of the displayed signal.

The level and frequency values measured by the marker are displayed in the marker field at the top edge of the screen. They can be taken as the measurement result.

```
Marker 1 [T1 ]
      -10.01 dBm
      10.000000000 MHz
```

The field header indicates the number of the marker (Marker 1) and the trace on which the marker is located ([T1] = Trace 1).

Increasing the Frequency Resolution

The frequency resolution of the marker is predefined by the measurement point resolution of the trace. A trace uses 625 measurement points, i.e. when the frequency span is 1 MHz, each measurement point corresponds to a span of approx. 1.6 kHz. This corresponds to a maximum uncertainty of 0.8 kHz.

You can increase the measurement point resolution of the trace by reducing the frequency span.

Reduce the frequency span (SPAN) to 10 kHz

- Press the *SPAN* key.
- Using the numeric keypad, enter *10* in the entry field and confirm the entry with the *kHz* key.

The generator signal is measured using a span of 10 kHz. The measurement point resolution of the trace is now approx. 16 Hz (10 kHz span / 625 measurement points), i.e. the precision of the marker frequency display increases to approx. ± 8 Hz.

Setting the Reference Level

With analyzers, the reference level (*REF LEVEL*) is the level at the upper limit of the diagram. To achieve the widest dynamic range possible for a spectrum measurement, use the entire level span of the analyzer. In other words, the highest level that occurs in the spectrum must be located at the top edge of the diagram (=reference level) or immediately below it.



Note

If the reference level that is selected is less than the signal amplitude that is present at the baseband input, the signal path in the R&S FMU will be overloaded.

In this case, the message *OVL*D will appear on the left-hand edge of the diagram.

In the preset setting, the value of the reference level is +10 dBm - equal to a peak voltage of 1 V. If the input signal is -10 dBm, the reference level can be reduced by 20 dB without causing the signal path to be overloaded.

1. Reduce the reference level by 15 dB.

- Press the *AMPT* key.
The *AMPT* menu will appear in the softkey bar. The *REF LEVEL* softkey will be highlighted in red to indicate that it is activated for data entry. The entry field for the reference level is also opened and displays a value of 10 dBm.
- Using the numeric keypad, enter 5 and confirm the entry with the *-dBm* key.
The reference level is now set to -5 dBm. The maximum of the trace is near the maximum of the measurement diagram. However, the increase in the displayed inherent noise is not substantial. Thus, the distance between the signal maximum and the noise display (=dynamic range) has increased.

2. Setting the marker level equal to the reference level.

The marker can also be used to shift the maximum value of the trace directly to the top edge of the diagram. If the marker is located at the maximum level of the trace (as in this example), the reference level can be moved to the marker level as follows:

- Press the *MKR*-> key.
- Press the *REF LEVEL = MKR LVL* softkey.
The reference level will be set equal to the measured level where the marker is located.

Thus, setting the reference level is reduced to two keystrokes.

Measuring Harmonics of Sinusoidal Signals

Measuring the harmonics of a signal is a very common task that can be optimally performed by using an analyzer.

In the following example, a generator signal with 1.5 MHz and -10 dBm is used.

Measuring the Suppression of the Second and Third Harmonic of an Input Signal

1. Reset the instrument.

- Press the *PRESET* key.
The R&S FMU is now in the default state.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Setup the instrument for real signals.

- Press the *SIGNAL SOURCE* softkey.
- Press the *IQ PATH* softkey.
- Press the *I ONLY* softkey.

4. Set the start frequency to 1 MHz and the stop frequency to 5 MHz.

- Press the *FREQ* key.
- Press the *START* softkey and enter 1 MHz.
- Press the *STOP* softkey and enter 5 MHz.
The R&S FMU displays the fundamental, the second, and the third harmonics of the input signal.

5. For maximum sensitivity, set the reference level to -10 dBm.

- Press the *AMPT* key.
- Press the *REF LEVEL* softkey and enter 10 -dBm.

6. Activate the marker.

- Press the *MKR* key.
Marker 1 will be activated and positioned to the signal maximum (fundamental at 1.5 MHz). The level and frequency of the marker will be displayed in the marker information field.

7. Activate the delta marker and measure the harmonic suppression.

- Press the *MARKER 2* softkey in the marker menu.
Marker 2 will be activated as the delta marker (Delta 2 [T1]). It automatically appears on the largest harmonic of the signal. The frequency offset and level offset from marker 1 are displayed in the marker field at the top edge of the screen.

➤ Press the *MARKER 3* softkey in the marker menu.

Marker 3 is activated as the delta marker (Delta 3 [T1]). It automatically appears on the next largest harmonic of the signal. The frequency offset and level offset from marker 1 on the fundamental are displayed in the marker field at the top edge of the screen. (see Fig. 5-1)

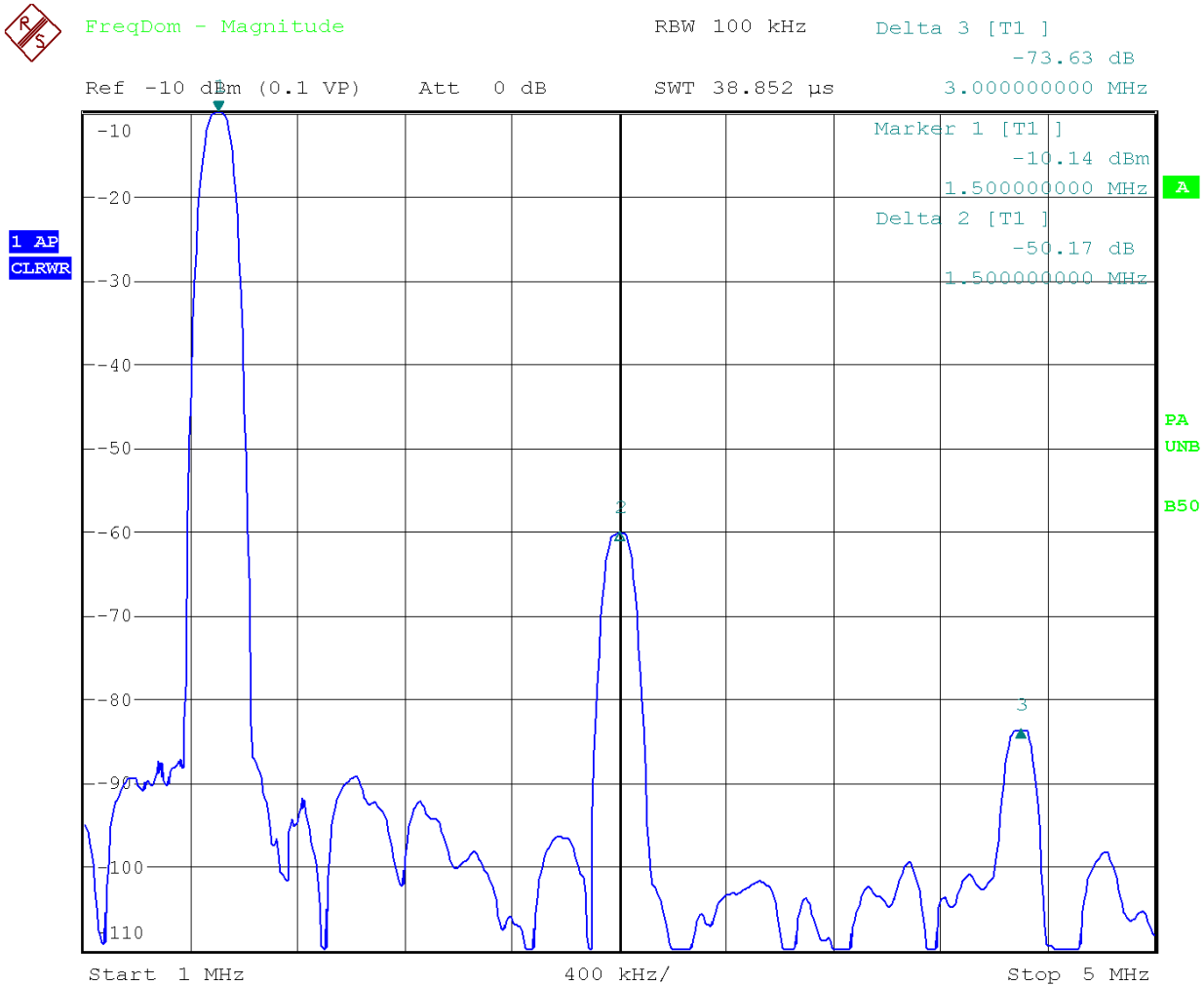


Fig. 5-1 Measuring the harmonic suppression of a reference generator. Markers delta 2 [T1] and delta 3 [T1] show the offset of the second and third harmonics from the fundamental.

Reducing Noise

The R&S FMU offers two means of effectively differentiating the harmonics of a signal from the noise:

- Averaging the trace
- Reducing the resolution bandwidth

Averaging the trace causes the noise from the R&S FMU or the DUT to be reduced, depending on which component is larger. Both methods reduce the measurement uncertainty particularly in the case of small signal-to-noise ratios, because the measurement signal is also separated from the noise.

1. Reduce the noise by averaging the curve.

- Press the *TRACE* key.
- Press the *AVERAGE* softkey.

The noise component of the trace will be smoothed by averaging 10 successive traces.

2. Switch off trace averaging.

- Press the *CLEAR/WRITE* softkey.

3. Reduce the noise by reducing the measurement bandwidth.

The noise is reduced in proportion to the bandwidth by reducing the resolution bandwidth, i.e. reducing the resolution bandwidth by a factor of 10 also reduces the noise power by a factor of 10 (which corresponds to 10 dB). The amplitude of sinusoidal signals is not affected by reducing the resolution bandwidth.

4. Set the resolution bandwidth to 1 kHz.

- Press the *BW* key.
- Press the *RES BW MANUAL* softkey and enter *1 kHz*.

The noise decreases by approx. 20 dB with respect to the previous setting. Because the resolution bandwidth has been reduced by factor 100, the sweep time increases by the same factor from 38 μ s to 3.8 ms.

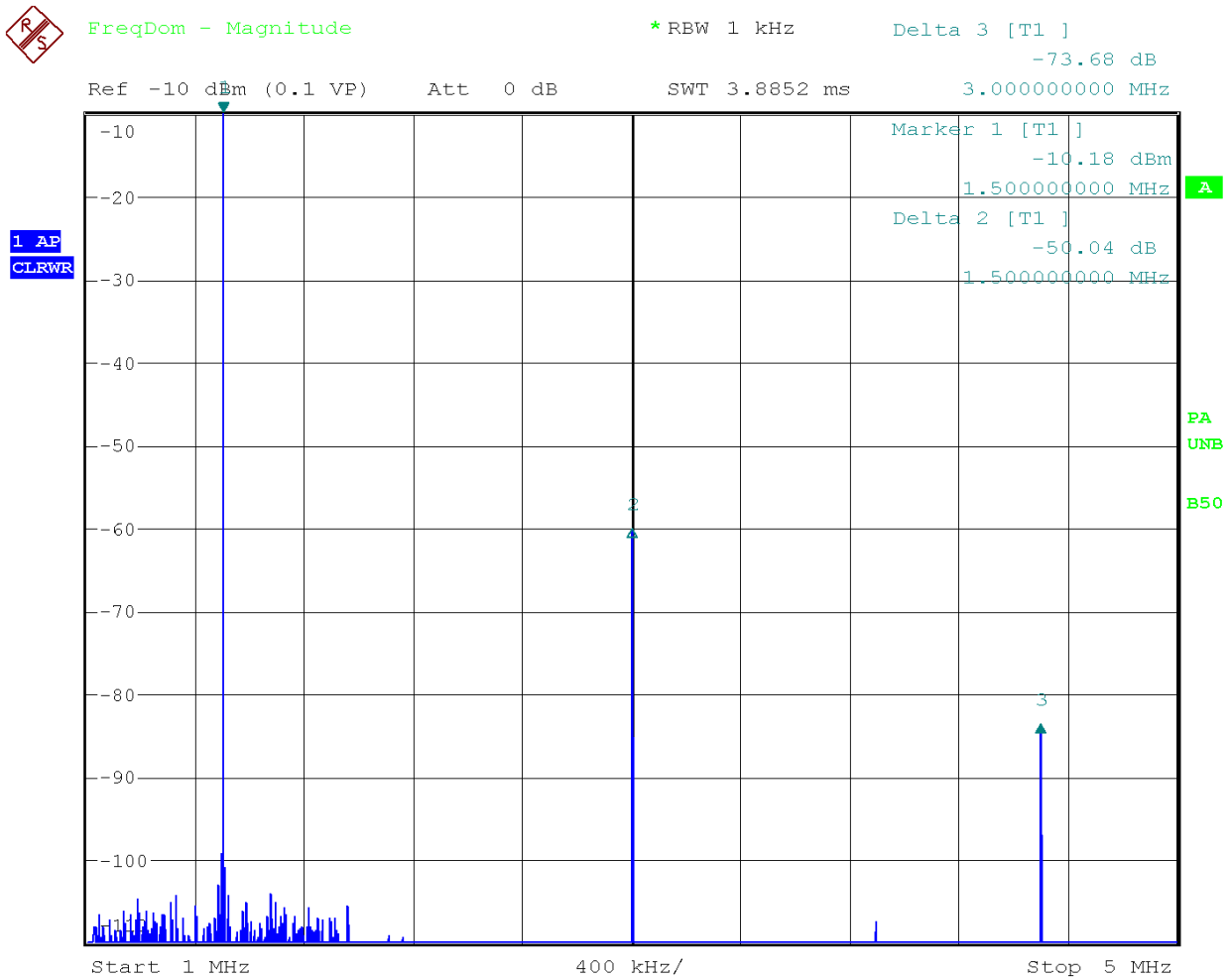


Fig. 5-2 Suppression of noise during harmonics measurement by reducing resolution bandwidth

Measuring the Output Level of a Signal Generator over a Large Level Range

Due to the excellent level linearity of the R&S FMU, exact measurements of the output level of a signal generator over a large range are possible. The following example shows how to use the properties of the R&S FMU to the best advantage.

To optimize the linearity of the A/D converter, the dithering is activated.

In the following measurement example, the output attenuator of a signal generator is tested by measuring the relative output level (dB) against a reference level.

The highest level to be measured is 0 dBm, the lowest -110 dBm. The reference level is -20 dBm. The frequency is 27 MHz.

1. Reset the instrument.

- Press the *PRESET* key.
The R&S FMU is now in the default state.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Setup the instrument for real signals.

- Press the *SIGNAL SOURCE* softkey.
- Press the *IQ PATH* softkey.
- Press the *I ONLY* softkey.

4. Activate Dithering.

- Press the *FFT HOME* hotkey.
- Press the *SIGNAL SOURCE* softkey.
- Set the *DITHER* softkey to *ON*.

5. Set the center frequency to 27 MHz and the span to 10 kHz.

- Press the *FREQ* key and enter 27 MHz.
- Press the *SPAN* key and enter 10 kHz.

6. Set the reference level to the highest level to be measured: 0 dBm.

- Press the *AMPT* key and enter 0 dBm.
Now the noise floor is outside the 100 dB display range.

7. Increase the display range to 140 dB.

- Press the *RANGE LOG MANUAL* softkey and enter 140 dB.

8. Reduce the resolution bandwidth so that the noise floor is about 15 dB lower than the lowest level to be measured, at approx. -125 dBm.

- Press the *BW* key.

- Press the *RES BW MANUAL* softkey and enter 30 Hz.

9. Connect the signal to be measured to the I INPUT input on the instrument front panel.

- Set the level of the signal generator to that value, the measurement shall be referenced to, for example -20 dBm.

10. Activate the marker.

- Press the *MKR* key.
Marker 1 will be activated and positioned at the signal maximum. The level and frequency of the marker will be displayed in the marker field.

11. Set the measured level as the reference value.

- Press the *REFERENCE FIXED* softkey.
Marker 2 will be activated as the delta marker (Delta 2 [T1 FXD]). The fixed reference is indicated by two red display lines, a frequency line and a level line.

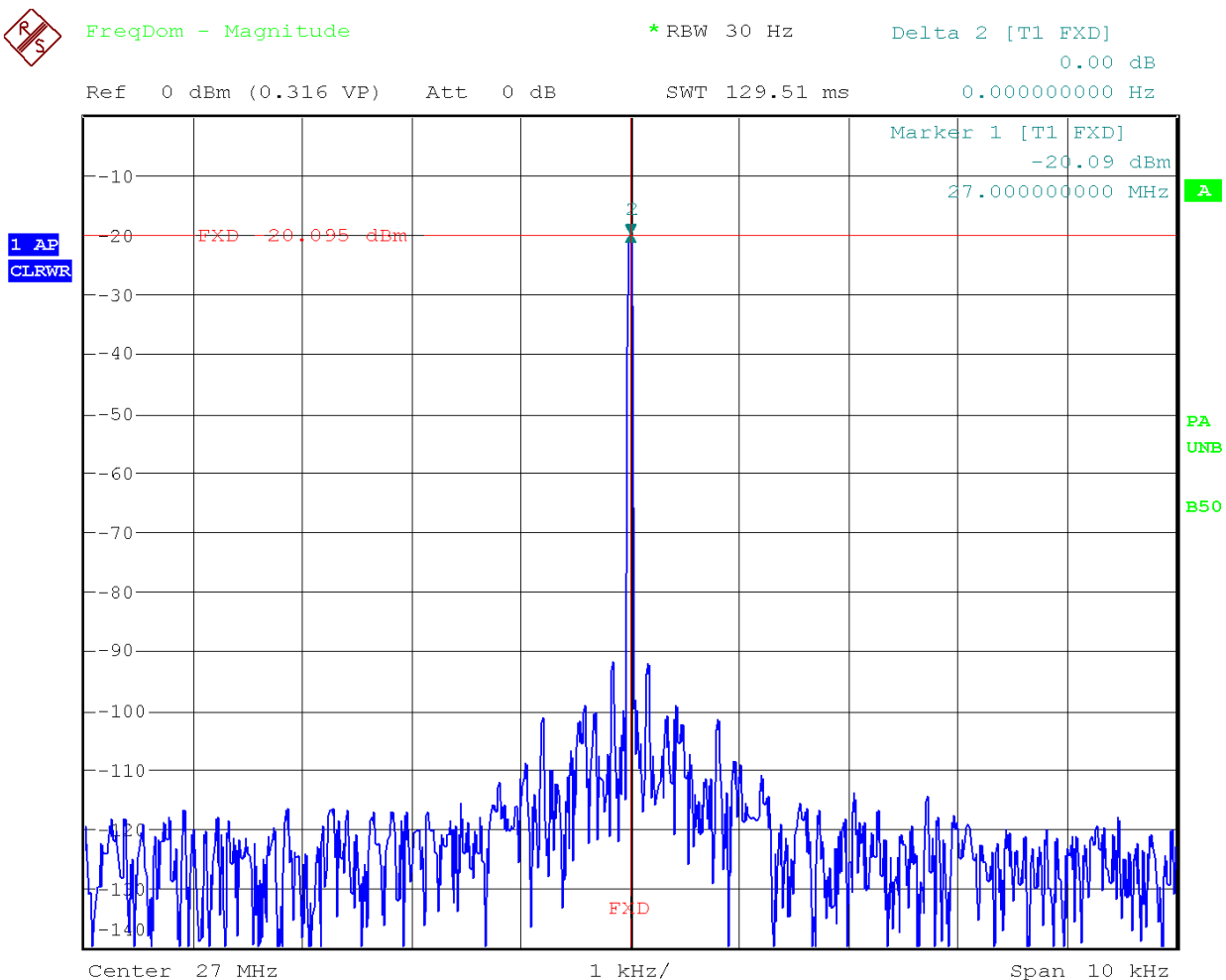


Fig. 5-3 The current level is hold as a fixed reference for subsequent measurements.

12. Step through the levels to be measured.

Delta marker 2 indicates the current level relative (in dB) to the fixed reference.

- Set the level of the signal generator to *-85 dBm*.
The noise floor is approx. at *-125 dBm*. With signal levels of *<-85 dBm*, the signal level to noise ratio falls below *40 dB* and the level display becomes more and more instable.

13. Switch on trace averaging.

- Press the *TRACE* key.
- Press the *AVERAGE* softkey.
The marker readout is stable again.

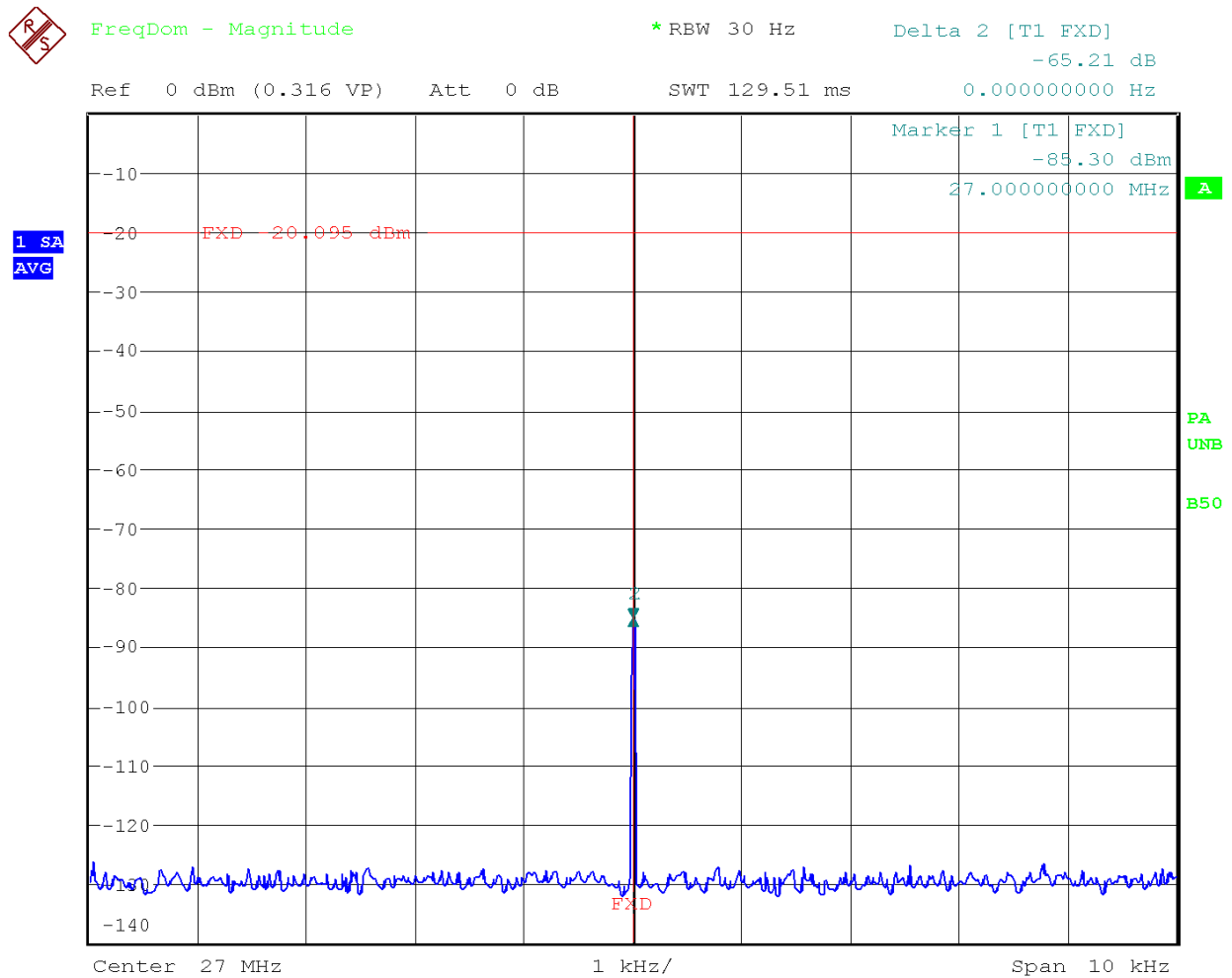


Fig. 5-4 At lower signal to noise ratios, averaging stabilizes the level reading.

14. Restart averaging after changing levels.

With averaging on, an average restart is necessary, whenever the signal level is changed. Otherwise the different levels will be averaged and it takes a long time to get a stable reading.

- Set the level of the signal generator to *-100 dBm*.
- Press the *CLEAR WRITE* softkey and then press the *AVERAGE* softkey again.

15. Measuring the lowest level with a higher number of averages.

- Set the level of the signal generator to -110 dBm.
- Press the SWEEP COUNT softkey and enter 100.
- Press the ENTER key or any of the unit keys.

The high number of averages gives a more stable readout than with the standard setting of 10. Wait until the 100 averages are done before you read the marker indication. The current number of averages is displayed on screen.

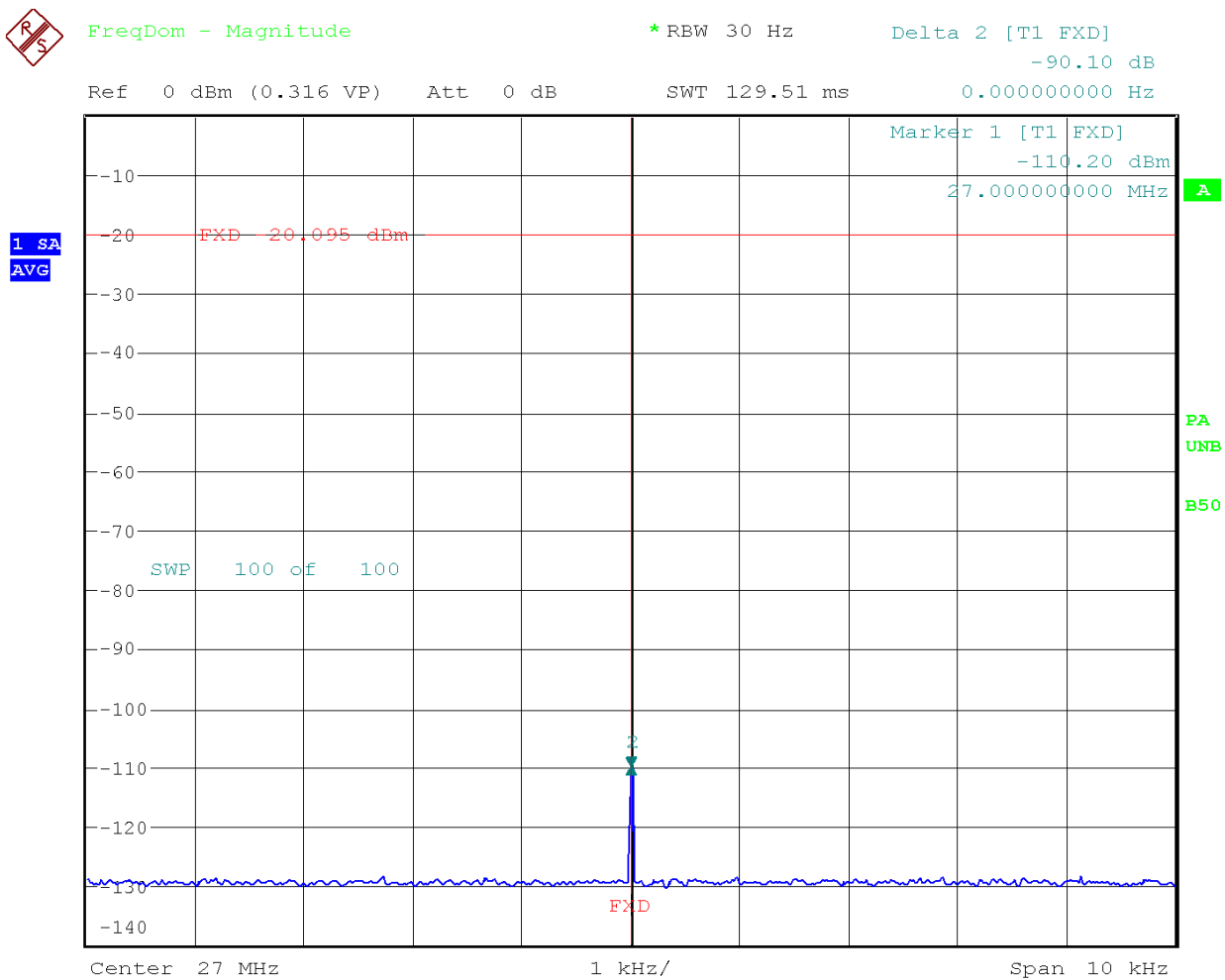


Fig. 5-5 At very low signal to noise ratios a higher number (100) of averages is used to stabilize the level reading.



Note

In this measurement, the reference level has not been modified in purpose in order to use the excellent linearity of the A/D converter of typ. < 0.01 dB. If the reference level is modified, attenuators and preamplifiers are switched which causes a typ. error of 0.1 dB.

Measuring Signal Spectra with Multiple Signals

Separating Signals by Selecting the Resolution Bandwidth

A basic feature of an analyzer is being able to separate the spectral components of a mixture of signals. The resolution at which the individual components can be separated is determined by the resolution bandwidth. Selecting a resolution bandwidth that is too large may make it impossible to distinguish between spectral components, i.e they will appear as a single component.

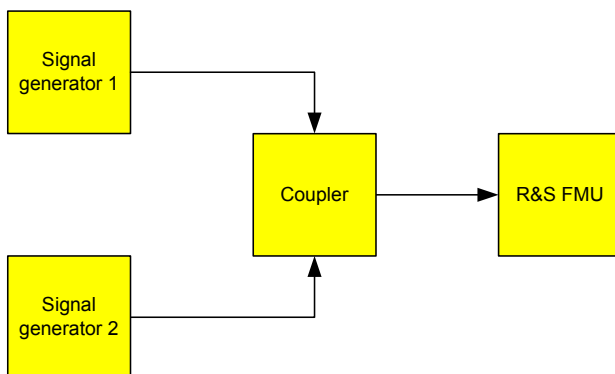
A sinusoidal signal will be shown on the analyzer screen by means of the passband characteristic of the resolution filter (RBW) that has been set. Its specified bandwidth is the noise bandwidth which equals approximately the 3 dB bandwidth of the filter.

Two signals can be resolved clearly if the resolution bandwidth is at least two times smaller than the frequency spacing of the signals. If the resolution bandwidth is equal to the frequency spacing or larger, the spectrum display will show disturbances on the resolution filter shape.

The trade-off for higher spectral resolution at a narrower bandwidth is longer measurement times at the same span. Reducing the resolution bandwidth by a factor of 2 increases the measurement time by a factor of 2.

Separating Two Signals with a Frequency Spacing of 100 kHz

Test setup:



Setting the signal generators:

	Level	Frequency
Signal generator 1	-10 dBm	21.45 MHz
Signal generator 2	0 dBm	21.35 MHz

Operating steps on the R&S FMU:**1. Reset the instrument.**

- Press the *PRESET* key.
The R&S FMU is now in the default state.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Setup the instrument for real signals.

- Press the *SIGNAL SOURCE* softkey.
- Press the *IQ PATH* softkey.
- Press the *I ONLY* softkey.

4. Set the center frequency to 21.4 MHz and the frequency span (SPAN) to 2 MHz.

- Press the *FREQ* key and enter 21.4 MHz.
- Press the *SPAN* key and enter 2 MHz.

5. Set the resolution bandwidth to 50 kHz.

- Press the *BW* key.
- Press the *RES BW MANUAL* softkey and enter 50 kHz.
- The two signals can be clearly distinguished.

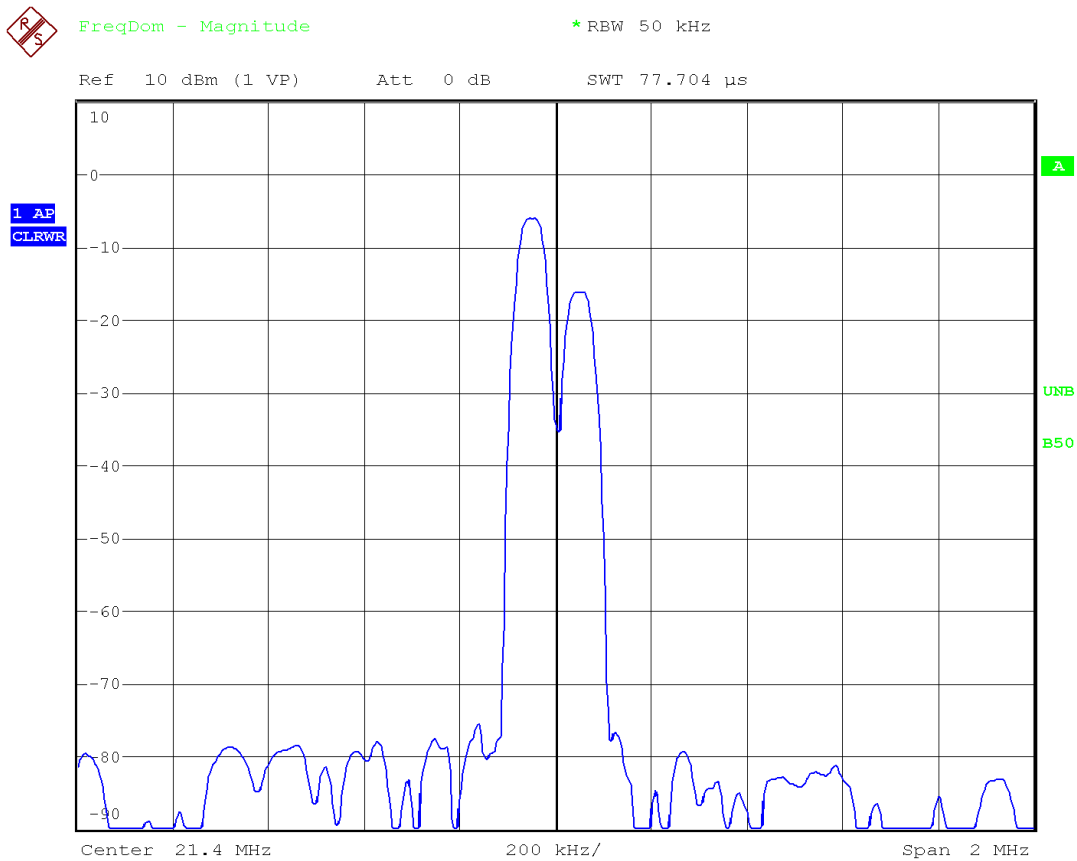


Fig. 5-6 Measurement of two sinusoidal signals with the resolution bandwidth which corresponds to one half of frequency spacing of the signals.

6. Set the resolution bandwidth to 200 kHz.

- Press the *RES BW MANUAL* softkey and enter *200 kHz*.
It is no longer possible to distinguish the two generator signals. The disturbances on the resolution filter shape indicate the presence of more than one signal.

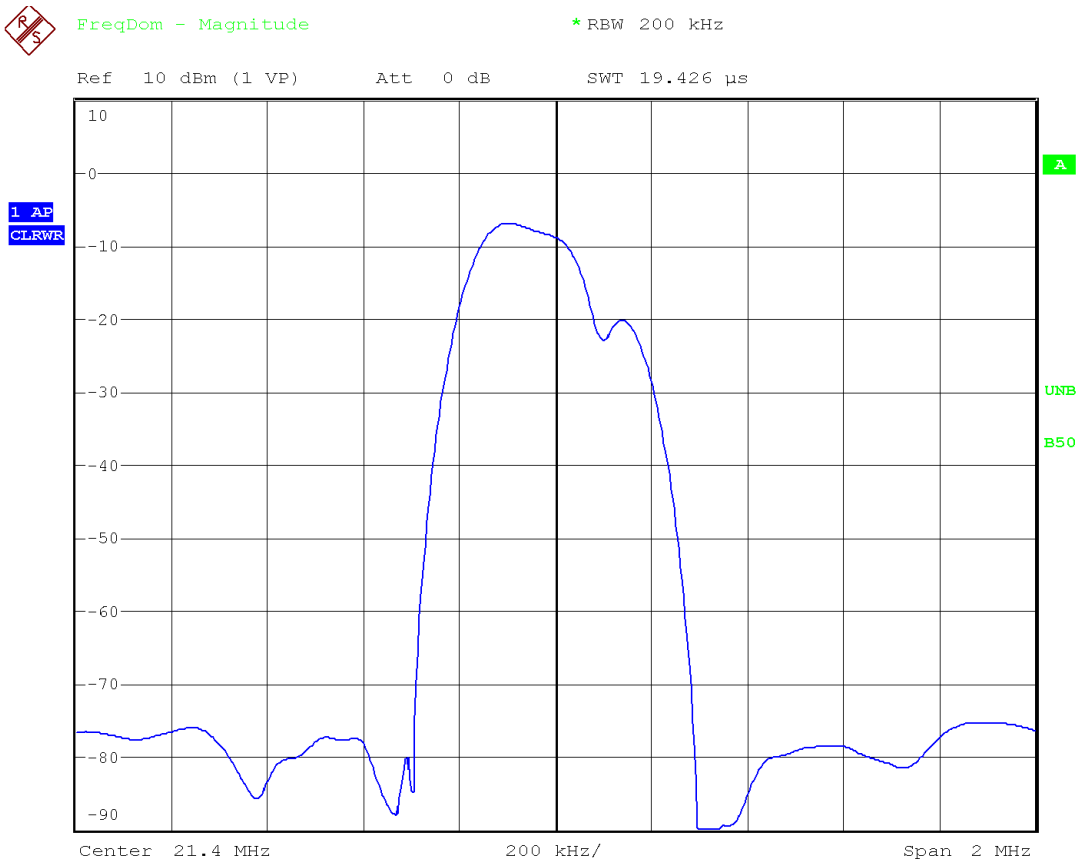


Fig. 5-7 Measurement of two sinusoidal signals with a resolution bandwidth which is larger than their frequency spacing.

The resolution bandwidth (RBW) can be reduced again by turning the rotary knob counterclockwise, thus yielding a higher frequency resolution.

7. Set the resolution bandwidth to 10 kHz.

- Turn the rotary knob counterclockwise until the bandwidth indicates 10 kHz. The two generator signals are shown with high resolution.

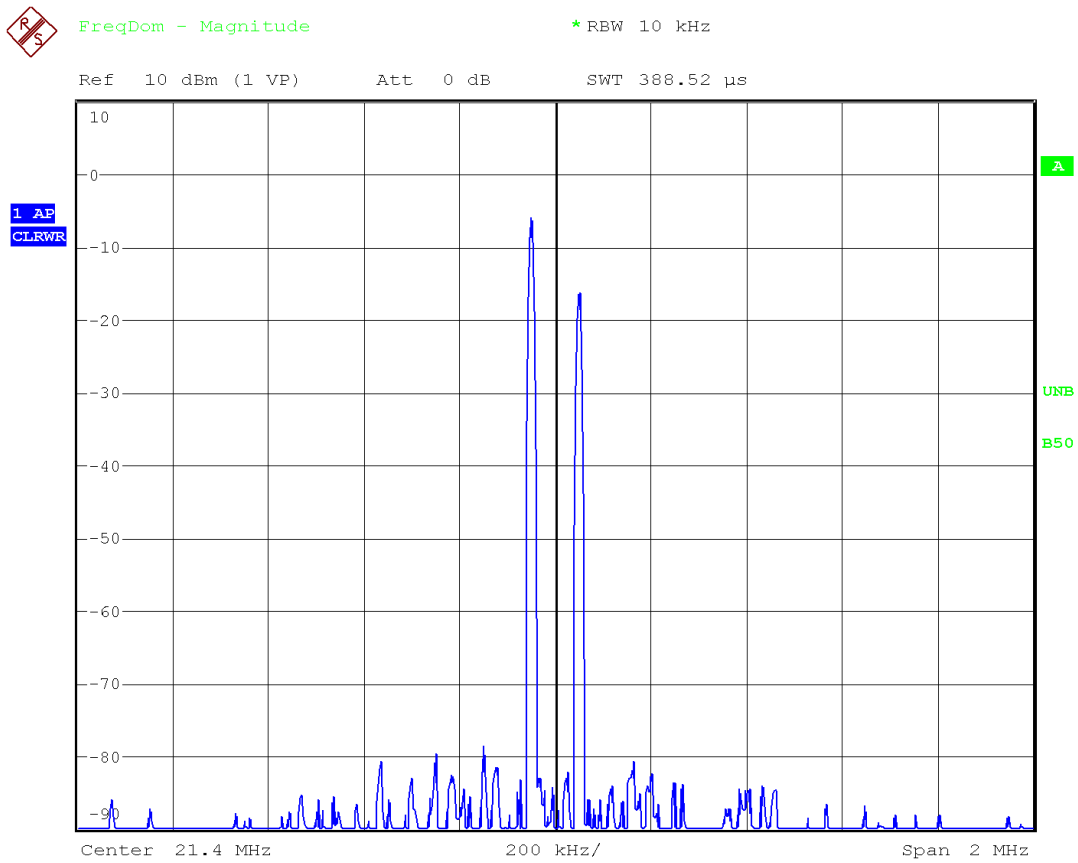
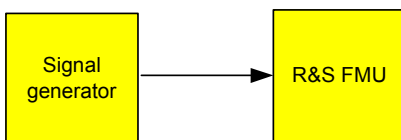


Fig. 5-8 Measurement of two RF equally-sized sinusoidal signals with a resolution bandwidth (10 kHz) which is clearly smaller than their frequency spacing.

Measuring the Modulation Depth of an AM-Modulated Carrier in the Frequency Domain

In the frequency domain display, the AM side bands can be resolved with a narrow bandwidth and measured separately. The modulation depth of a carrier modulated with a sinusoidal signal can then be measured. Since the dynamic range of an analyzer is very large, extremely small modulation depths can also be measured precisely. For this purpose, the R&S FMU provides measurement routines that directly output the modulation depth numerically in %.

Test setup:



Settings on the signal generator (e.g. R&S SMIQ):

Frequency: 10 MHz
Level: -10 dBm
Modulation: 50% AM, 1 kHz AF

Measurement with the R&S FMU:

1. Reset the instrument.

- Press the *PRESET* key.
The R&S FMU is now in the default state.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Setup the instrument for real signals.

- Press the *SIGNAL SOURCE* softkey.
- Press the *IQ PATH* softkey.
- Press the *I ONLY* softkey.

4. Set the center frequency to 10 MHz and frequency span (SPAN) to 5 kHz.

- Press the *FREQ* key and enter 10 MHz.
- Press the *SPAN* key and enter 5 kHz.

5. Activate the marker function for measuring the AM modulation depth.

- Press the MEAS key.
- Press the MODULATION DEPTH softkey.

The R&S FMU automatically sets a marker to the carrier signal in the center of the diagram and one delta marker each to the upper and lower AM sidebands. The R&S FMU calculates the AM modulation depth from the level differences of the delta markers to the main marker and outputs the numeric value in the marker information field.

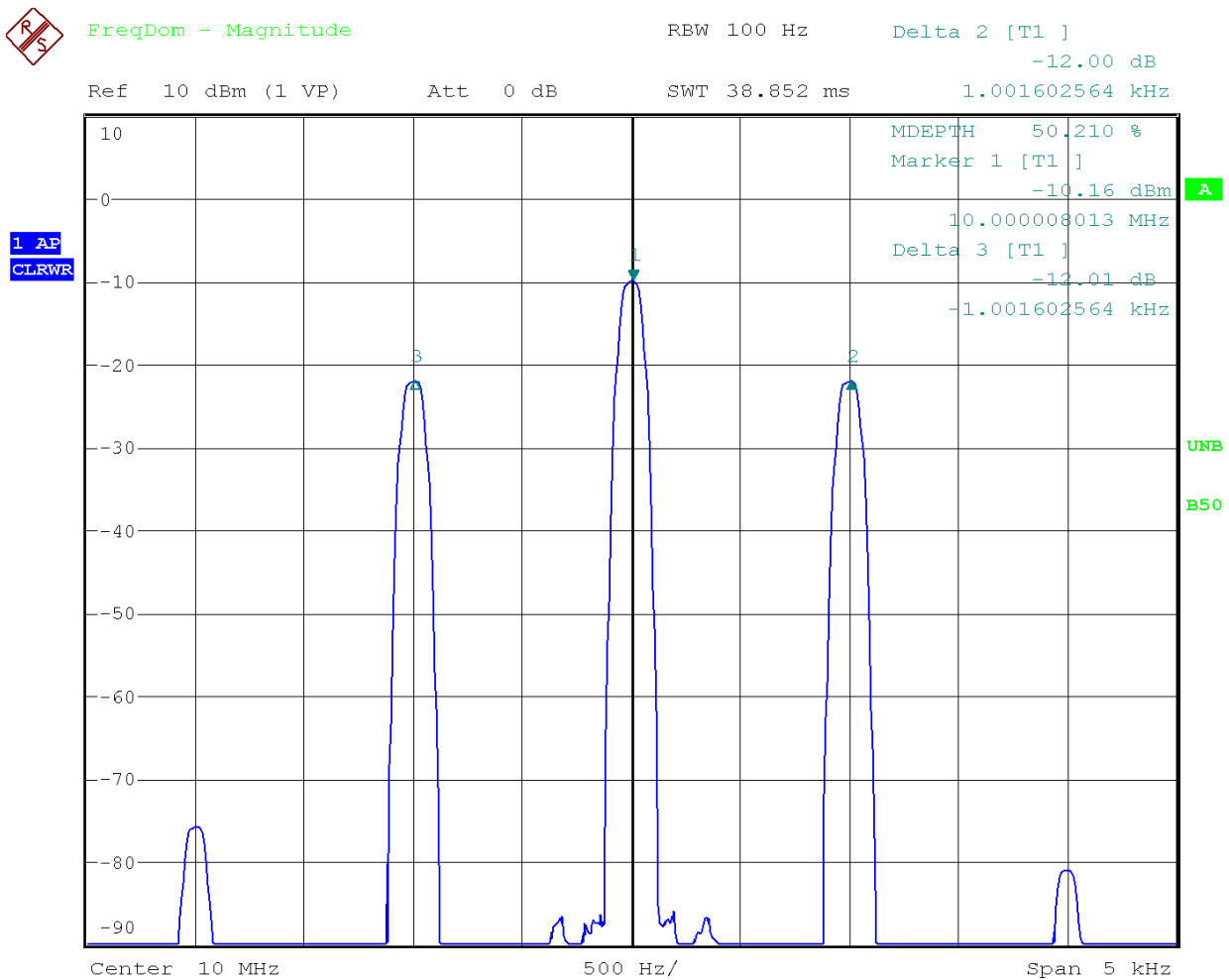


Fig. 5-9 Measurement of the AM modulation depth. The modulation depth shown is MDEPTH = 50.21%. The frequency of the AF signal can be obtained from the frequency display of the delta marker.

Measuring the Adjacent Channel Power Ratio of a 3GPP WCDMA Signal at a Baseband Signal Generator with a Differential Output

Test setup:



Settings on the signal generator (e.g. R&S AMIQ):

Frequency: Baseband
 Modulation: 3GPP WCDMA FWD
 Output: Differential
 Peak level: 1 V

Measurement with the R&S FMU:

1. Reset the instrument.

- Press the *PRESET* key.
The R&S FMU is now in the default state.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Setup the instrument for complex, differential signals.

- Press the *SIGNAL SOURCE* softkey.
- Set the *BALANCED* softkey to *ON*.



Note

The baseband input is set for complex signals in the default state.

4. Setup the ACP Measurement.

- Press the *MEAS* key.
- Press the *CHAN PWR / ACP* softkey.
- Press the *CP / ACP STANDARD* softkey.
- Select *W-WCDMA 3GPP FWD* from the table by turning the rotary knob.

- Confirm your selection by pressing the rotary knob or by pressing the *ENTER* key. The R&S FMU is set automatically according to the standard.

The channel power and the power ratio of two lower and upper adjacent channels is displayed in the lower screen half.

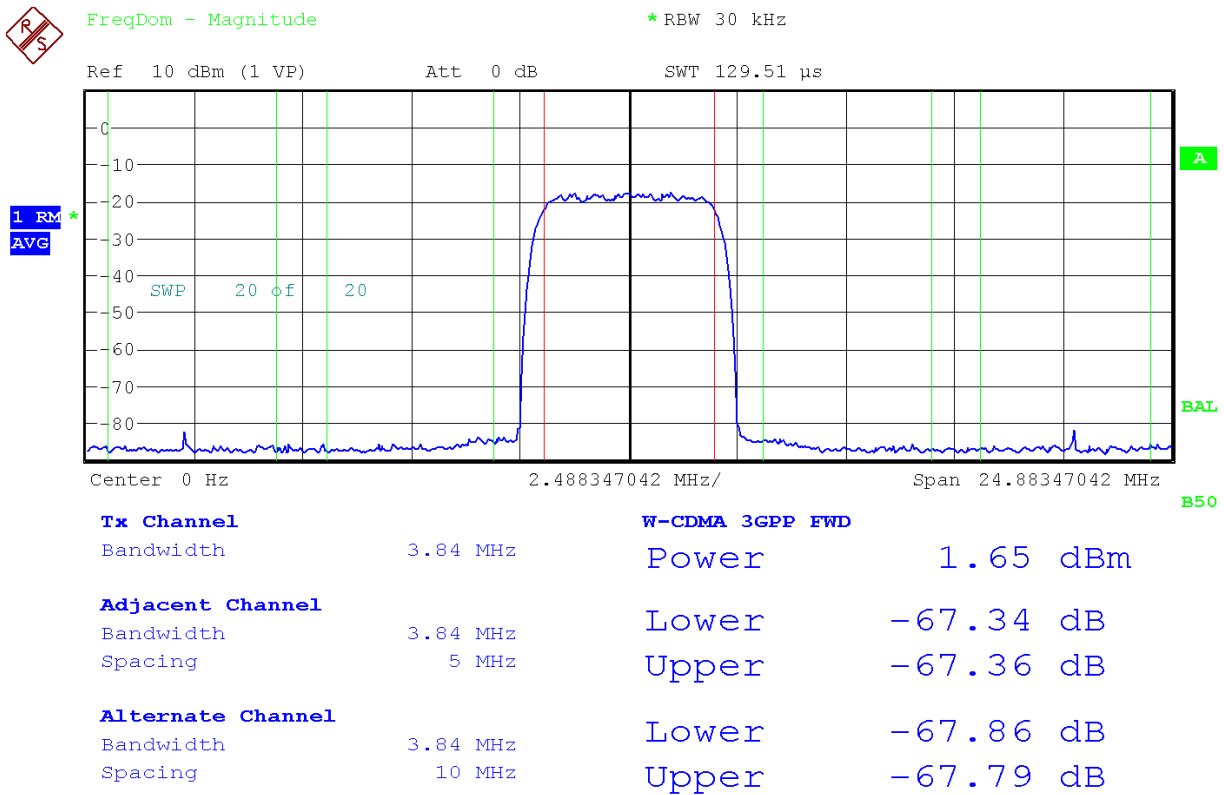


Fig. 5-10 Channel power and relative adjacent channel power measurement on a 3GPP WCDMA baseband signal.

5. Change the number of displayed adjacent channels.

- Press the *CP / ACP CONFIG* softkey.
- Press the *NO. OF ADJ CHAN* softkey.
- Enter 4 and confirm with the *ENTER* key.

Measurements in the Time Domain

In the case of radio transmission systems that use the TDMA method (e.g. GSM or IS136), transmission quality is determined not only by spectral characteristics but also by characteristics in the time domain. However, a timeslot is assigned to each user since several users share the same frequency. Smooth operation is ensured only if all users adhere exactly to their assigned timeslots.

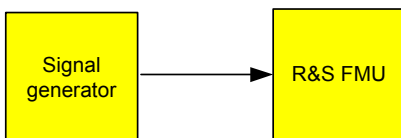
Both the power during the send phase as well as the timing and duration of the TDMA burst and rise and fall times of the burst are important.

Measuring the Power Characteristic

For measuring power in the time domain, the R&S FMU offers easy-to-use functions that measure the power over a predefined time.

Example – Measuring the Power of a GSM Burst During the Activation Phase.

Test setup:



Settings on the signal generator (e.g. R&S SMIQ):

Frequency: 10 MHz
Level: 0 dBm
Modulation: GSM, one timeslot activated

Measurement with the R&S FMU:

1. Reset the instrument.

- Press the *PRESET* key.
The R&S FMU is now in the default state.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Setup the instrument for real signals.

- Press the *SIGNAL SOURCE* softkey.
- Press the *IQ PATH* softkey.
- Press the *I ONLY* softkey.

4. Switch over to time domain display.

- Press the *SPAN* key and enter *0 Hz* or press the *ZEROSPAN* softkey.
(Alternatively, press the *FFT HOME* hotkey and then the *TIME DOMAIN* softkey.)

5. Set the center frequency to 10 MHz and the resolution bandwidth to 1 MHz.

- Press the *FREQ* key and enter *10 MHz*.
- Press the *BW* key and enter *1 MHz*.

6. Set the sweep time to 1 ms.

- Press the *SWEEP* key and enter *1 ms*.
The R&S FMU will show the GSM burst continuously across the display.

7. By using the I/Q Level trigger, elicit triggering on the rising edge of the burst.

- Press the *TRIG* key.
- Press the *I/Q LEVEL* softkey and enter *50 mV*.
The R&S FMU shows a static image with the GSM burst at the start of the trace.

8. Configure power measurement in the time domain.

- Press the *MEAS* key.
- Press the *TIME DOM POWER* softkey.
- Set the *LIMITS* softkey to *ON*.
- Press the *START LIMIT* softkey.
- By turning the rotary knob clockwise, move the vertical line to the start of the burst.
- Press the *STOP LIMIT* softkey.
- By turning the rotary knob counterclockwise, set the second vertical line to the end of the burst.
The R&S FMU will output on screen the average (mean) power during the activation phase of the burst: Power [T1] RMS x.xx dBm.

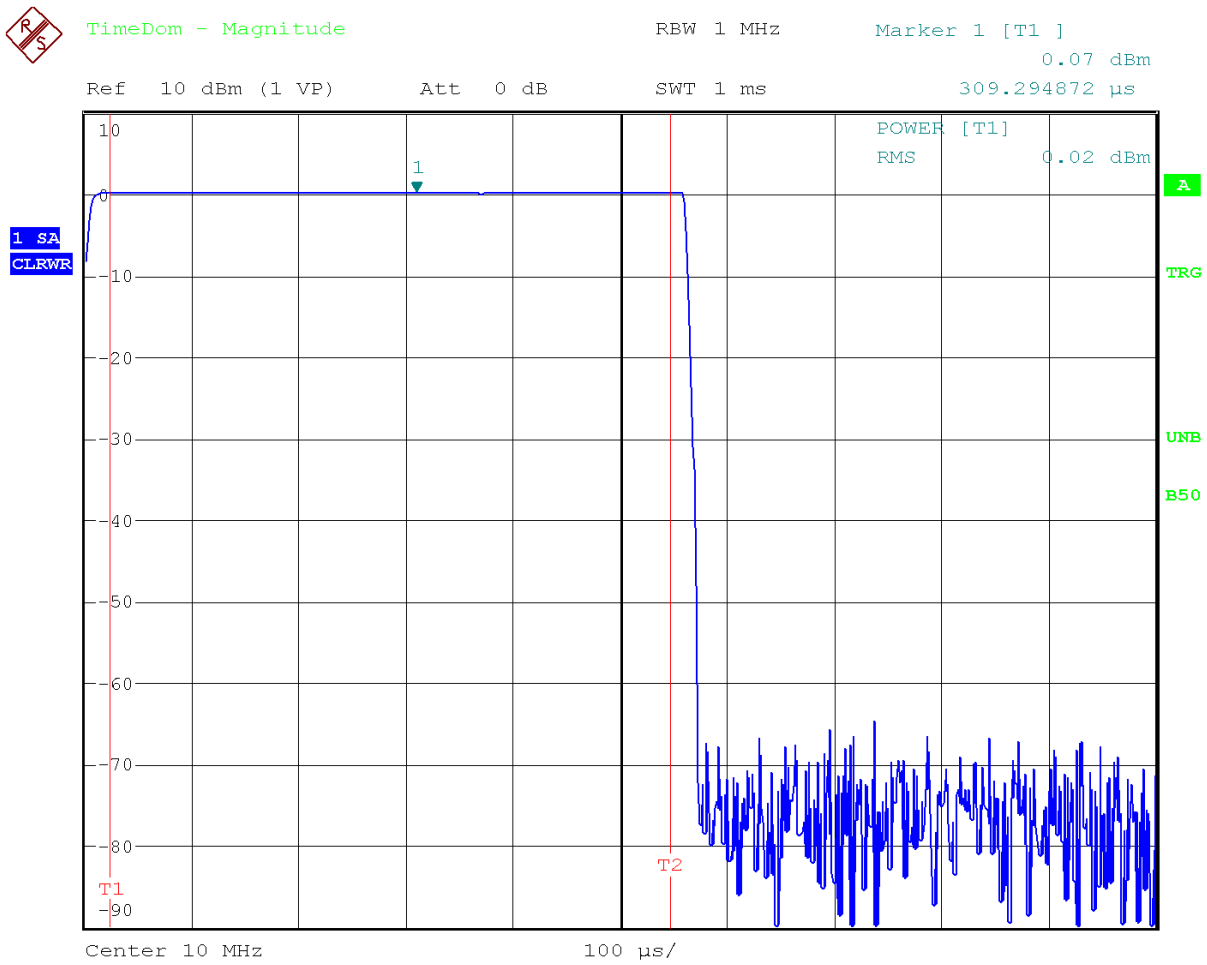


Fig. 5-11 Measurement of the average power during the activation phase of a GSM burst.

Measuring the Power Characteristic of Burst Signals

Because of the high time resolution of the R&S FMU at the 0 Hz display range, the edges of TDMA bursts can be measured precisely. The edges can be shifted to the screen area by using the trigger offset.

Example - Measuring the Edges of a GSM Burst with High Time Resolution

Measurement with the R&S FMU:

The measurement is based on the setting in the above example for measuring the power of the GSM during the activation phase.

1. Switch off the power measurement.

- Press the *MEAS* key.
- Press the *TIME DOM POWER* softkey.
- In the submenu, set the *POWER* softkey to *OFF*.

2. Increase the time resolution to 100 μ s.

- Press the *SWEEP* key and enter 100 μ s.

3. Using the trigger softkey, shift the rising edge of the GSM burst to the center of the screen.

- Press the *TRIG* key.
- Press the *TRIGGER OFFSET* softkey.

By turning the rotary knob counterclockwise, move the trigger offset until the burst edge can be seen in the center of the screen, or enter -50 μ s.

The R&S FMU will show the rising edge of the GSM burst.

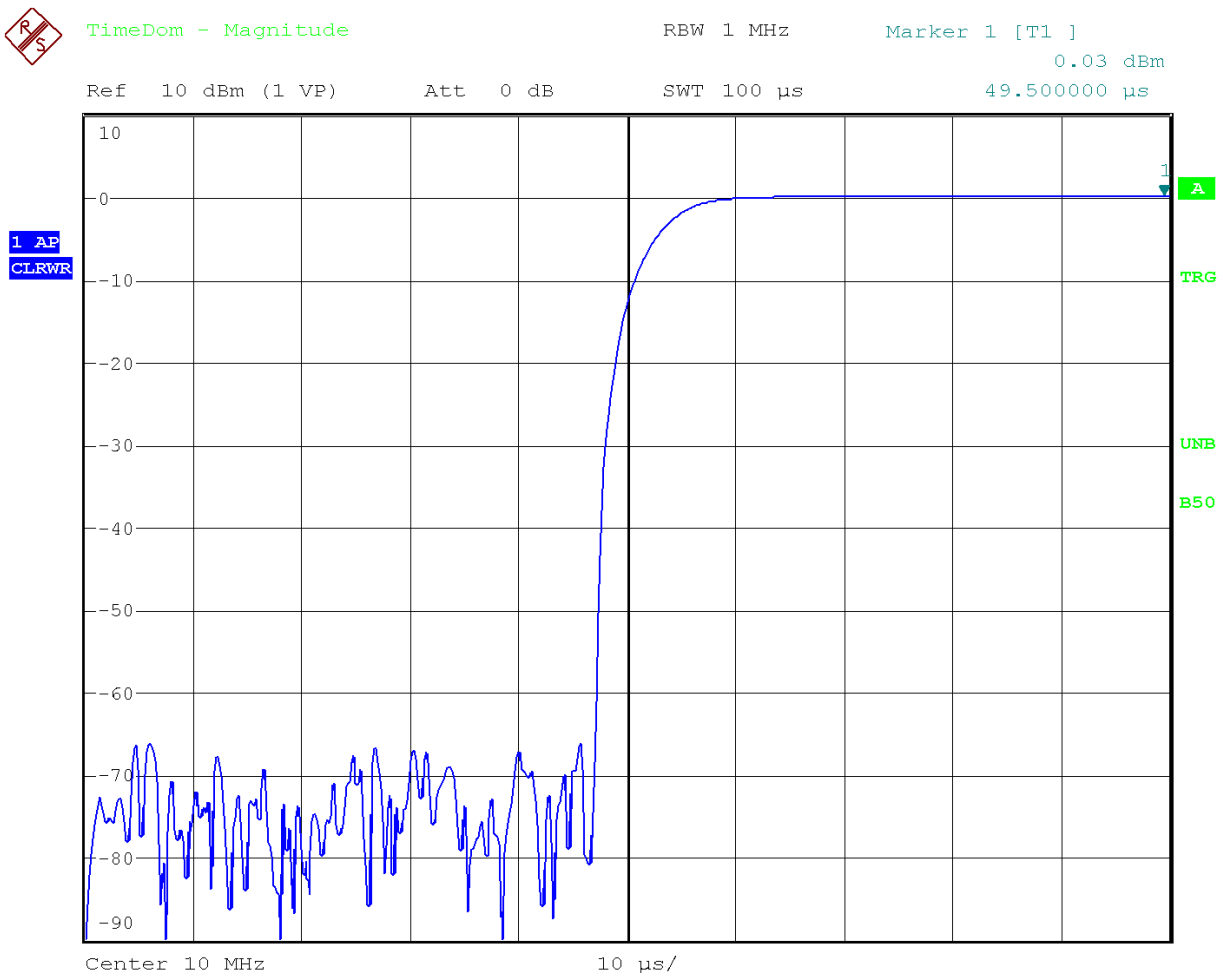


Fig. 5-12 Rising edge of the GSM burst displayed with high time resolution.

4. Using the trigger offset, move the falling edge of the burst to the center of the screen.

- Set the *POLARITY* softkey to *NEG*.
The R&S FMU will show the falling edge of the GSM burst.

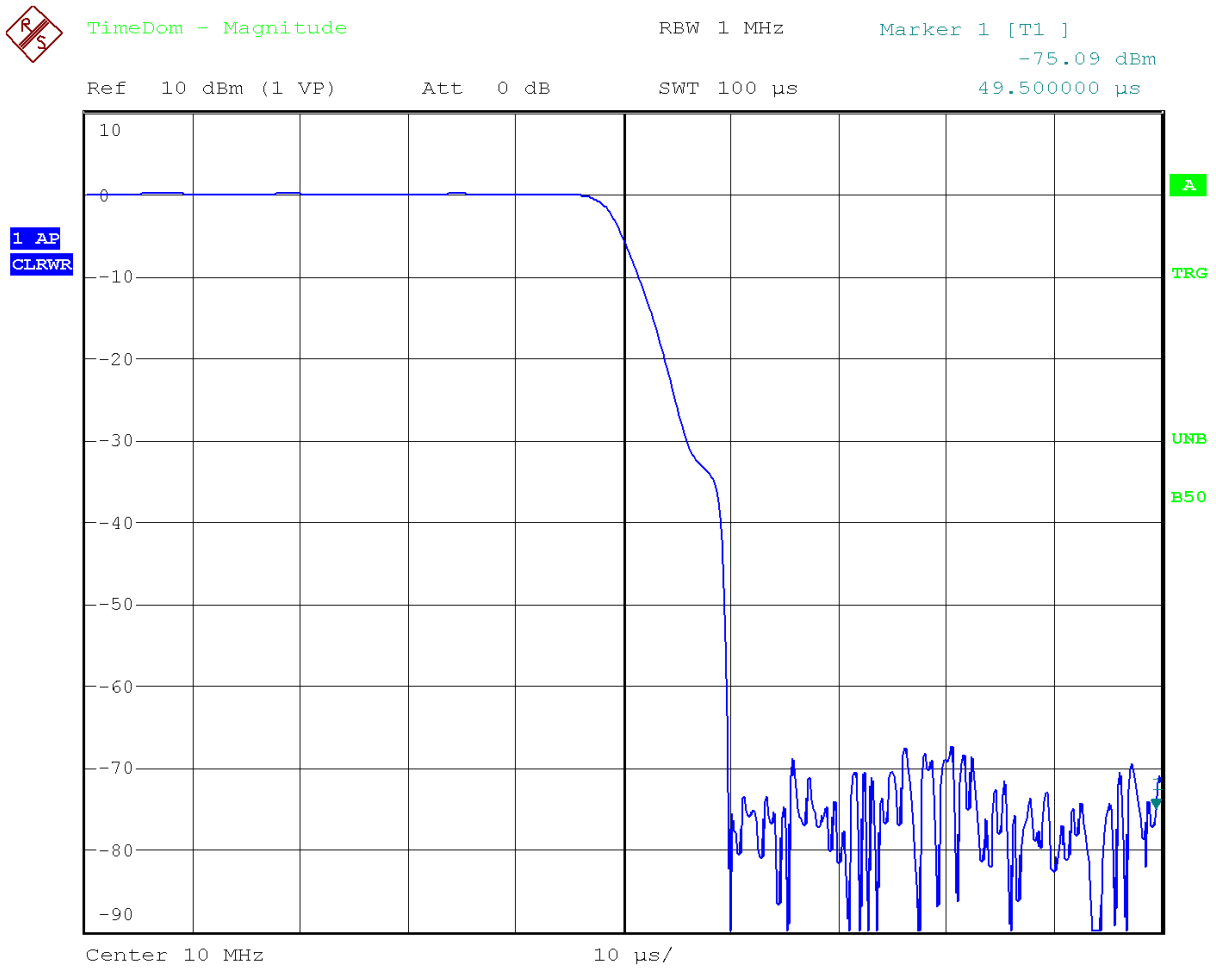


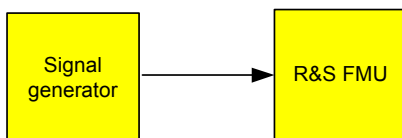
Fig. 5-13 Falling edge of the GSM burst displayed with high time resolution.

Measuring the Signal-to-Noise Ratio of Burst Signals

When TDMA transmission methods are used, the signal-to-noise ratio or the deactivation dynamic range can be measured by comparing the power values during the activation phase and the deactivation phase of the transmission burst. For this purpose, the R&S FMU provides the function for measuring absolute and relative power in the time domain. In the following example, the measurement is performed using a GSM burst.

Example - Signal-to-Noise Ratio of a GSM Signal

Test setup:



Settings on the signal generator (e.g. R&S SMIQ):

Frequency: 10 MHz
Level: 0 dBm
Modulation: GSM, one timeslot activated

Measurement with the R&S FMU:

1. Reset the instrument.

- Press the *PRESET* key.
The R&S FMU is now in the default state.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Setup the instrument for real signals.

- Press the *SIGNAL SOURCE* softkey.
- Press the *IQ PATH* softkey.
- Press the *I ONLY* softkey.

4. Set the center frequency to 10 MHz, the span to 0 Hz and the resolution bandwidth to 1 MHz.

- Press the *FREQ* key and enter 10 MHz.
- Press the *SPAN* key and enter 0 Hz.

or

- Press the *ZEROSPAN* softkey.
- Press the *BW* key and enter 1 MHz.

- 5. Set the reference level of the R&S FMU to 0 dBm (= level of the signal generator).**
 - Press the *AMPT* key and enter *0 dBm*.
- 6. Set the sweep time to 2 ms.**
 - Press the *SWEEP* key and enter *2 ms*.
The R&S FMU shows the GSM burst continuously across the display.
- 7. By using the I/Q Level trigger, elicit triggering on the rising edge of the burst and shift the start of burst to the center of the screen.**
 - Press the *TRIG* key.
 - Press the *I/Q LEVEL* softkey and enter *50 mV*.
The R&S FMU shows a static image with the GSM burst at the start of the trace.
 - Press the *TRIGGER OFFSET* softkey and enter *-1 ms*.
The R&S FMU shows the GSM burst in the right-hand half of the measurement diagram.
- 8. Configure the power measurement in the time domain.**
 - Press the *MEAS* key.
 - Press the *TIME DOM POWER* softkey.
 - Set the *LIMITS* softkey to *ON*.
 - Press the *START LIMIT* softkey.
 - Using the rotary knob, move the vertical line to the start of the burst.
 - Press the *STOP LIMIT* softkey.
 - Using the rotary knob, move the second vertical line to the end of the burst.
The R&S FMU outputs on screen the power during the activation phase of the burst.

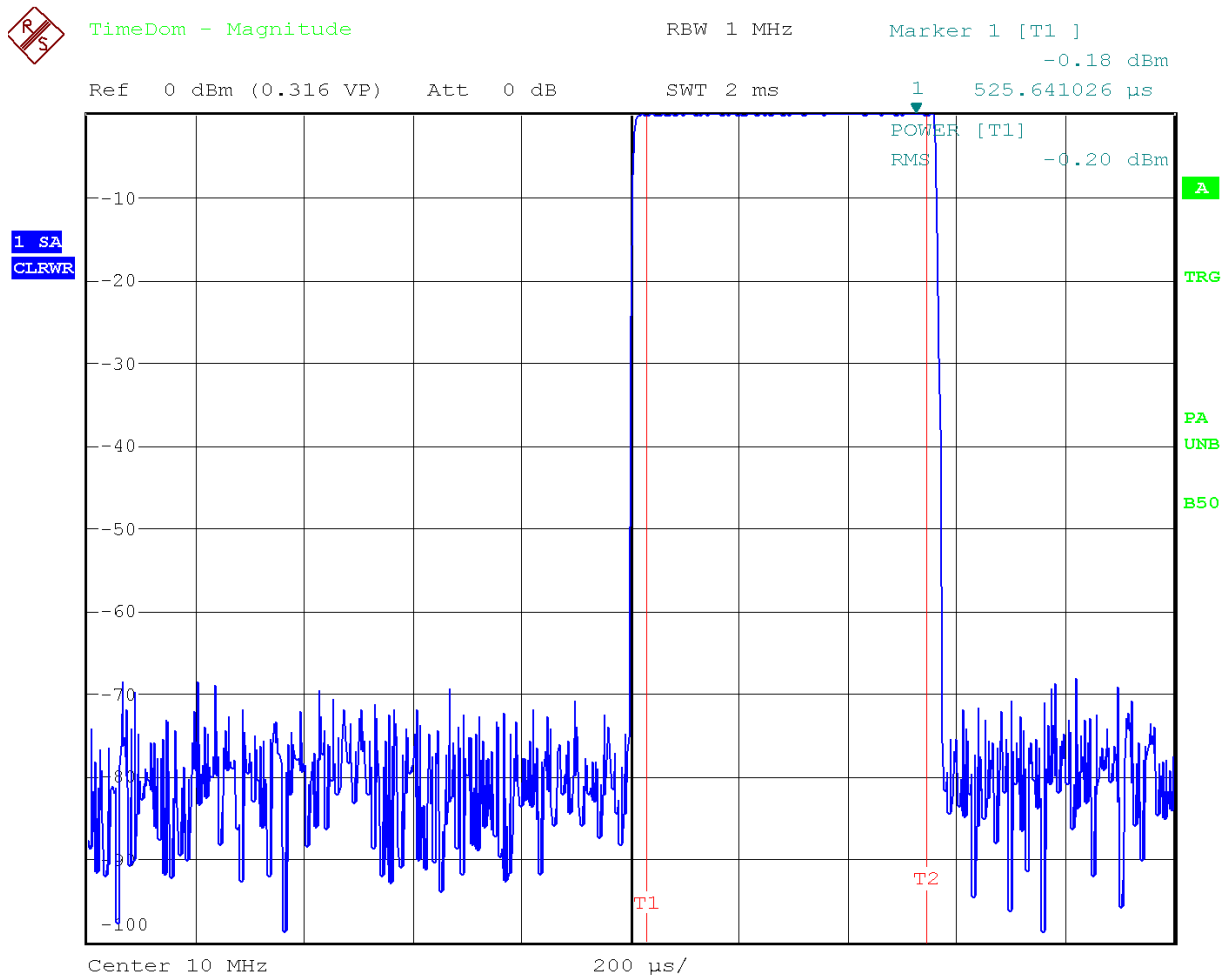


Fig. 5-14 Power measurement during the activation phase of the burst

9. Set the measured power as the reference and activate relative power measurement.

- Press the *NEXT* key.
The side menu for setting the power measurement will open.
- Set the *POWER ABS/REL* softkey to *REL*.
The power relative to the power during the activation phase of the burst is displayed.
- Press the *SET REFERENCE* softkey.
The measured power of the GSM burst is set as the reference.

10. Measure the power during the deactivation phase of the burst.

- Press the *TRIG* key.
- Set the *POLARITY POS/NEG* softkey to *NEG*.
The R&S FMU initiates triggering in response to the falling edge of the burst. This shifts the burst to the left-hand half of the measurement diagram. The power is measured in the deactivation phase. The start of the burst is shifted to the center of the screen and the power during the deactivation phase is measured relative to the reference power (= burst power).

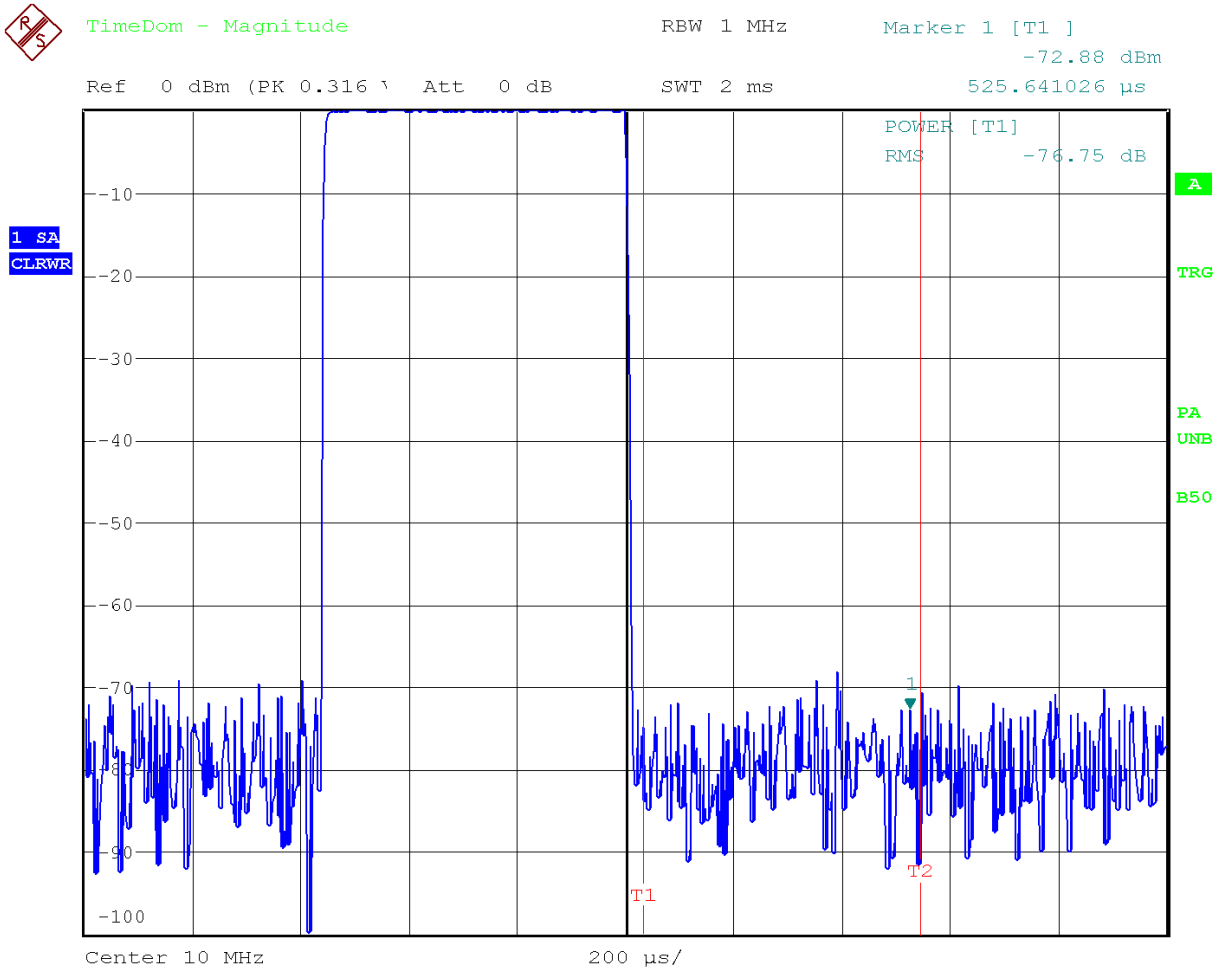
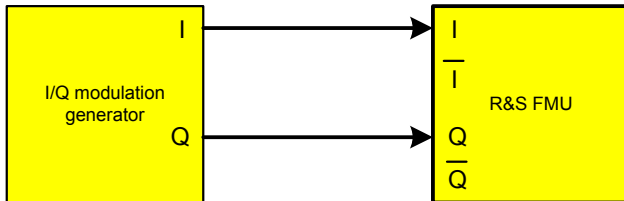


Fig. 5-15 Measurement of the signal-to-noise ratio of a GSM burst signal in the time domain.

Measuring Modulated Signals in the Time Domain

In the Time Domain Voltage mode, the R&S FMU measures like an oscilloscope, with the frequency conversion switched off (center freq. = 0).

Test setup:



Settings on the signal generator (e.g. R&S AMIQ):

Frequency:	Baseband
Modulation:	GSM, Power Ramping On, Data PRBS9
Output:	Single Ended
Peak level:	0.5 V

Measurement with the R&S FMU:

1. Reset the instrument.

- Press the *PRESET* key.
The R&S FMU is now in the default state.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Select the Time Domain Voltage mode.

- Press the *TIME DOMAIN* softkey.
- Press the *VOLTAGE* softkey.

4. Select adequate sweep time and triggering in response to the burst.

- Press the *SWEEP* key and enter $600 \mu\text{s}$.
- Press the *TRIGGER* key.
- Press the *I/Q LEVEL* softkey and enter 300 mV .

The R&S FMU displays the voltage versus time in two diagrams.

Screen A (upper diagram): real part, the signal at the I Input.

Screen B (lower diagram): imaginary part, the signal at the Q Input.

5. Activate the marker and measure the peak to peak voltage of the imaginary part (Q).

- Press the *SCREEN B* hotkey.
- Press the *MARKER* key.
Marker 1 jumps automatically to the positive peak of the signal in screen B.
- Press the *MARKER 2* softkey.
- Press the *MARKER->* key.
- Press the *NEXT* key.
- Press the *MIN* softkey.
Marker 2 is placed to the negative peak of the signal in screen B.

The peak to peak voltage is displayed in the marker field of screen B:
Delta 2 [T1] -1.022 V

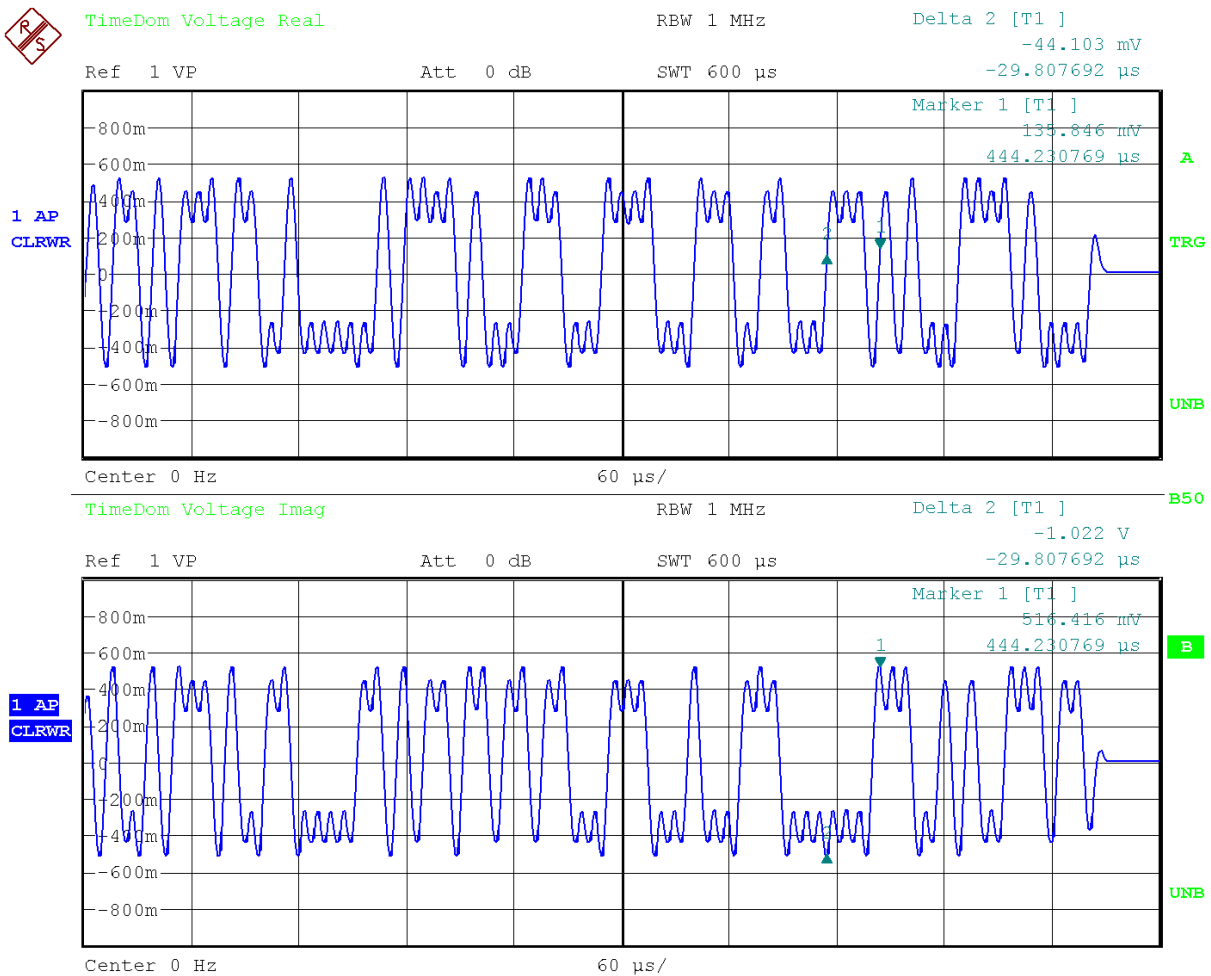


Fig. 5-16 Voltage versus time display of a GSM modulation signal (complex baseband signal).

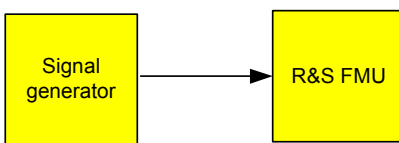
Measurement of AM-Modulated Signals

In the time domain (zero span), the analyzer displays the magnitude of the input signal versus time. AM-modulated signals are demodulated and the AF voltage can be displayed in the time domain if the modulation sidebands fall within the resolution bandwidth.

To avoid an attenuation of the AF amplitude, the resolution bandwidth must be at least 10 times larger than the modulation frequency.

Example - Displaying the AF of an AM-Modulated Signal in the Time Domain

Test setup:



Settings on the signal generator:

Frequency: 10 MHz
Level: 6 dBm
Modulation: 50% AM, 1 kHz AF

Measurement with the R&S FMU:

1. Reset the instrument.

- Press the *PRESET* key.
The R&S FMU is now in the default state.

2. Select the FFT analyzer mode.

- Press the *FFT* hotkey.

3. Setup the instrument for real signals.

- Press the *SIGNAL SOURCE* softkey.
- Press the *IQ PATH* softkey.
- Press the *I ONLY* softkey.

4. Set the center frequency to 10 MHz, the span to 0 Hz and the resolution bandwidth to 10 kHz.

- Press the *FREQ* key and enter 10 MHz.
- Press the *SPAN* key and enter 0 Hz.

or

- Press the ZEROSPAN softkey.
- Press the BW key and enter 10 kHz.

5. Set the reference level of the R&S FMU to 0 dBm (= level of the signal generator + 6dB).

- Press the AMPT key and enter 0 dBm.

6. Set the display range to linear with 0 to 100% scaling.

- Press the RANGE LINEAR softkey.
- Press the RANGE LINEAR % softkey.

7. Elicit triggering in response to the AF signal by using the I/Q Level trigger to produce a static image.

- Press the TRIG key.
- Press the I/Q LEVEL softkey and enter 50 mV.

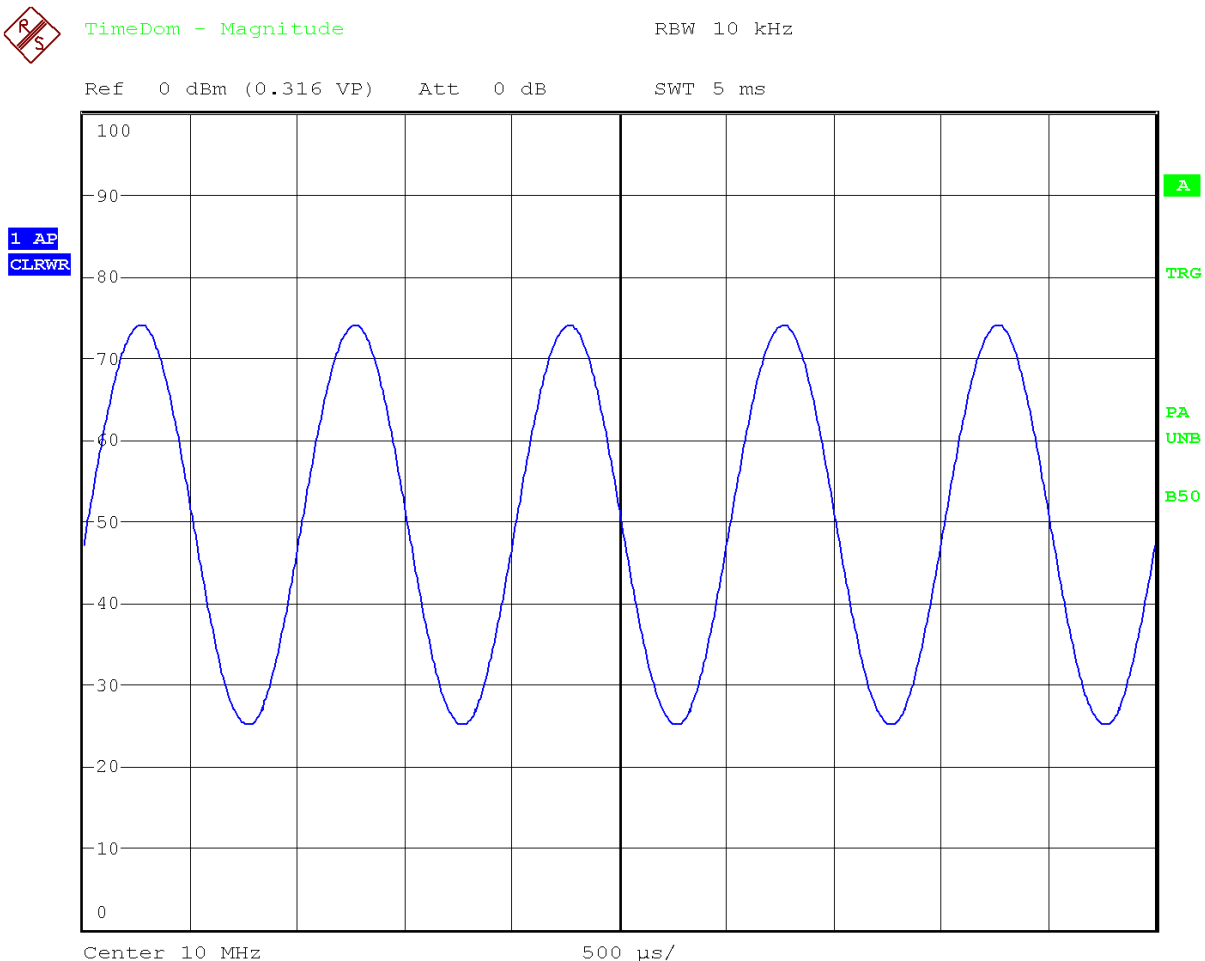


Fig. 5-17 Measurement of the AF signal of a carrier that is AM-modulated with 1 kHz

Storing and Loading Instrument Settings

The R&S FMU can store complete instrument settings together with instrument configurations and measurement data internally as a data record. The data is stored on the built-in hard disk or – if selected – on a network drive or a removable drive (e.g. a memory stick). The hard disk has the name D: (drive C: is reserved for the operating system).

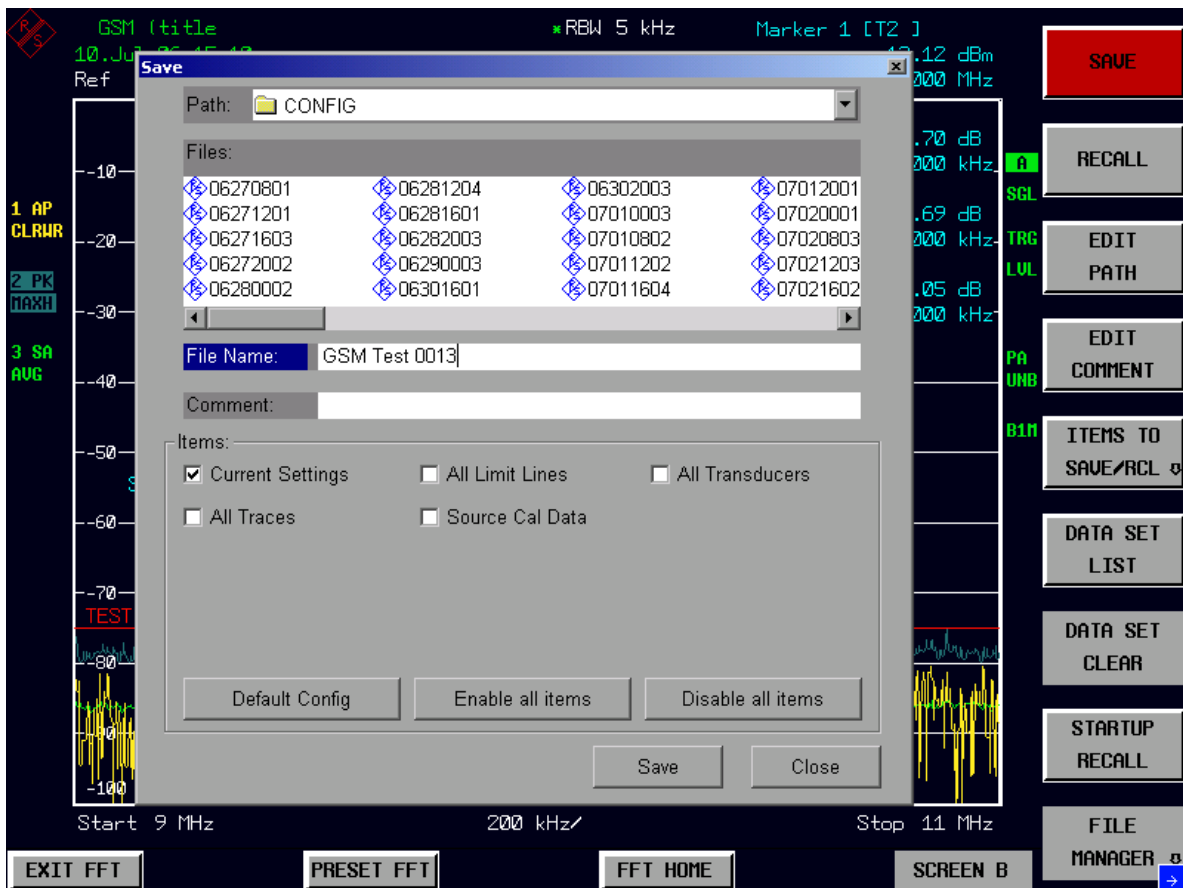
The preset state (= *Current Settings*) includes that the settings of the measurement functions, *activated* limit lines and the *active* transducer factor are stored.

Use the *ITEMS TO SAVE/RCL* function to store/load traces and to store additional limit lines and transducer factors.

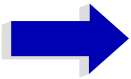
Storing an Instrument Configuration (without Traces)

You can store an instrument configuration as follows:


- Press the *FILE* key and then the *SAVE* softkey.
The selection dialog box for instrument configurations will open:



- Enter the name of the data record to be stored (which is a digit from 0 to 9 in the simplest case) and press *ENTER*. The data record will be stored and the dialog box will close.

**Notes**

The name of a data record may contain letters and digits. If necessary, the desired directory can be placed in front of the name of the data record (the directory will then automatically be used for any further save and recall operations).

You can enter file names via the front panel keypad by using the alphanumeric editor, which can be called by pressing the arrow key .

The operation of the editor is described in the section [“Editing Alphanumeric Parameters”](#) on page 4.9.

The default path for the instrument configurations is *D:\USER\CONFIG*. The file names of the data records end with “.FSP”.

Storing Traces

Before you can store traces, you must first select the associated partial data record. For this purpose proceed as follows:

- Press the *FILE* key and then the *SAVE* softkey.
- Press the *ITEMS TO SAVE/RCL* softkey. The entry cursor jumps to the first entry in the *Items* field.
- Using the rotary knob, move the cursor to *All Traces* in the *Items* field and then select the partial data record by pressing the rotary knob or *ENTER*.

**Notes**

You can cancel the selection by pressing the rotary knob or the *ENTER* key again.

You can select additional instrument settings to be stored by marking additional fields.

In addition, the *ENABLE ALL ITEMS / DISABLE ALL ITEMS* softkeys are available for selecting all partial data records or for cancelling the selection.

- Using the rotary knob, move the cursor to the *File Name* field and activate text entry by pressing the rotary knob.
- Enter a file name (or digit from 0 to 9) and store the data record by pressing *ENTER*.

Loading an Instrument Configuration

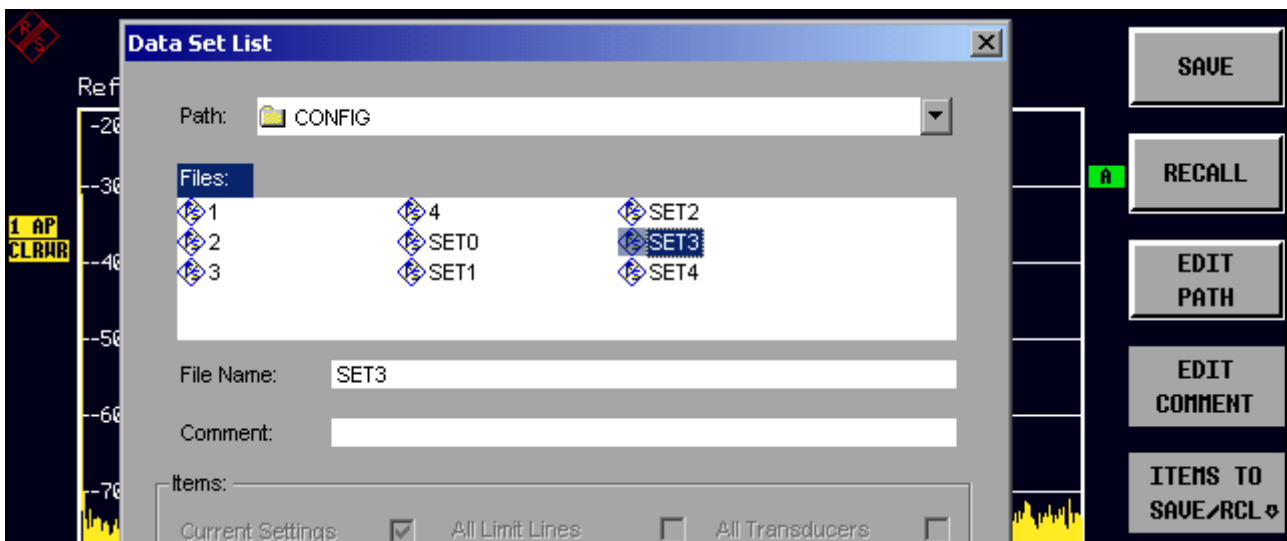
An instrument configuration can be loaded in either of the following two ways:

1. By directly entering the data record name:

- Press the *FILE* key and then the *RECALL* softkey.
- Enter the name of the data record to be loaded (which is a digit from 0 to 9 in the simplest case) and press *ENTER*. The data record will be loaded.

2. By selecting the data record from a list:

- Press the *FILE* key and then the *RECALL* softkey.
- Press the *ITEMS TO SAVE/RCL* softkey.
The list of available data records is shown.



- Select the data record to be loaded by using the rotary knob and confirm by pressing *ENTER* twice. The data record will be loaded.

To change the instrument configuration path, use the *EDIT PATH* softkey.



Notes

To load stored traces, use the *ITEMS TO SAVE/RCL* softkey to select the *All Traces* field.

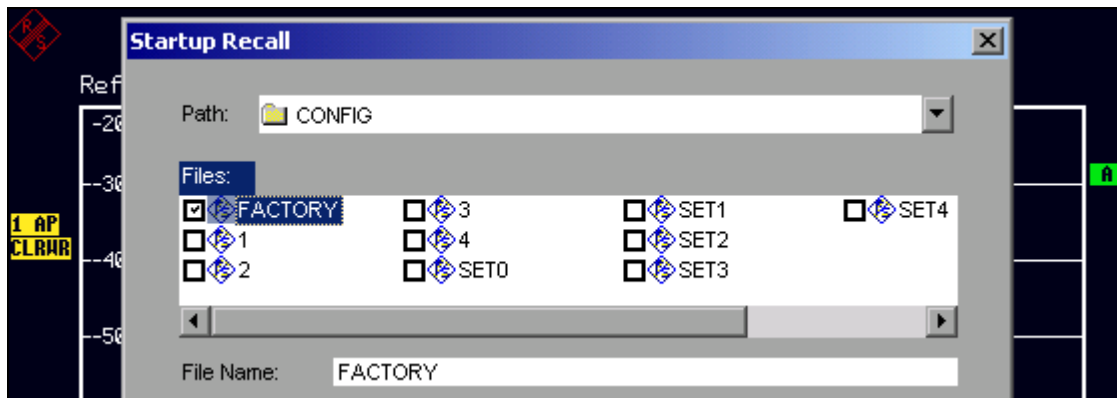
During loading, the R&S FMU detects which parts the called data record contains and, if applicable, ignores any partial data records that were selected but are not available.

Automatic Loading of a Data Record during Booting

If the R&S FMU is switched on in the factory default state, it loads the instrument settings that it had when switched off (provided that it was switched off using the *STANDBY* switch on the front panel; see chapter “Switching Off the R&S FMU” on page 2.6).

However, the R&S FMU can also automatically load a data record defined by the user. This requires performing the following procedure:

- Press the *FILE* key and then the *RECALL* softkey.
- Press the *STARTUP RECALL* softkey.
The list of available data records is shown.



- Select the data record to be loaded by using the rotary knob and mark it with *ENTER*.
- Close the dialog box by pressing *ESC* twice.



Notes

- The selected data record will also be loaded by pressing the *PRESET* key.
- The *FACTORY* entry activates factory-default operation, i.e. the settings that were present at the time of deactivation will be loaded at activation.
- If you need to change the path for the instrument configuration, do so by using the *EDIT PATH* softkey.

Printing Out the Measurement Results

- Press the *HCOPY* key.
The menu for starting and configuring the printout will appear.
- Start the print operation by pressing the *PRINT SCREEN*, *PRINT TRACE* or *PRINT TABLE* softkey. The printout is based on the settings defined in the *DEVICE SETUP* dialog box and the *COLORS* submenu.



Notes

- If *PRINT SCREEN* is selected, all diagrams with traces and status displays will be printed out as they appear on screen. Softkeys, open tables and data entry fields will not appear on the printout.
- If *PRINT TRACE* is selected, only the displayed traces will be printed out. If *PRINT TABLE* is selected, only tables that appear on screen will be printed out.

-
- Select and configure the output interface by using the *DEVICE 1 / 2* softkey.
 - You can redirect the printout to a file by selecting *PRINT TO FILE* from the *DEVICE SETUP* dialog box. Once you start the print operation by pressing one of the *print* softkeys, you will be prompted for the name of the file to which the output is to be redirected.
 - The *COMMENT* softkey is available for labelling the printout (the date and time will automatically be added to the printout).

Selecting the Color Setting for the Printout

The *COLORS* submenu allows you to switch between black-and-white and color printouts (default). You can also select the color setting.

- *SCREEN*: Output using screen colors.
- *OPTIMIZED* (default): Instead of the bright colors for traces and markers, dark colors will be used: blue for trace 1, black for trace 2, green for trace 3, turquoise for markers.
- *USER DEFINED*: You can use this setting to customize the colors. The possible settings correspond to those in the *DISPLAY – CONFIG DISPLAY – NEXT* menu.

**Notes**

- In the case of the *SCREEN* and *OPTIMIZED* settings, the background is always printed out in white and the grid in black. In the case of the *USER DEFINED* setting, these colors can also be selected.
 - When you open the submenu, the color display will be switched to the selected printout colors. When you exit the menu, the original color setting will be restored.
-

Additional Measurement Examples

The measurement examples provided in this section are intended as an introduction to operating the R&S FMU. For enhanced applications, refer to the Operating Manual, chapter 2, which provides a series of additional examples.

Measurement examples for the instrument's options are provided in the Operating Manuals for the individual options.

6 LAN Interface



Note

In some of the following step-by-step instructions, user names and passwords must be entered. This requires a mouse and an external keyboard is (the connection is described in sections [“Connecting a Mouse”](#) and [“Connecting an External Keyboard”](#) on page 2.7).

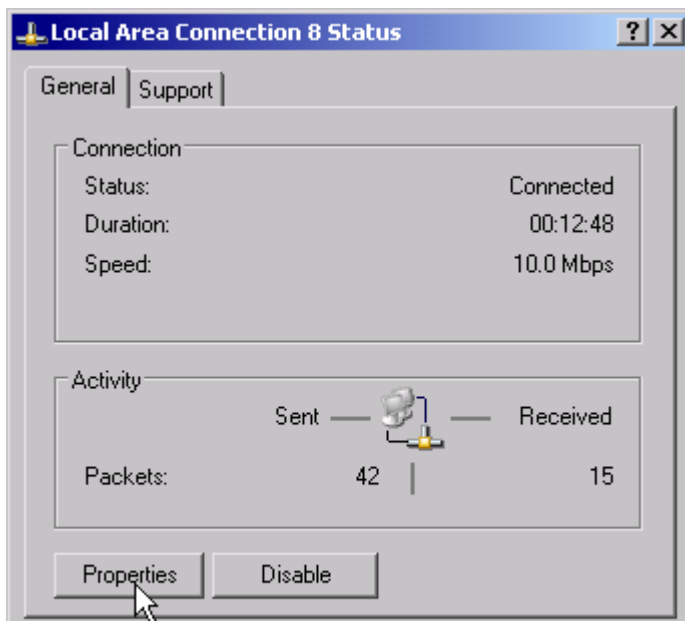
Installing Additional Network Protocols and Services (e.g. Novell Netware Support)

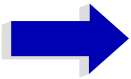


Note

Your network administrator knows which protocols are necessary. In the case of the RSIB protocol and VXI11 support, TCP/IP must always be installed. In the following example, the support for Novell Network will also be installed.

- Press the *SETUP* key.
The *SETUP* menu will open.
- Press the *GENERAL SETUP* softkey.
The *GENERAL SETUP* menu will open.
- Press the *CONFIGURE NETWORK* softkey.
The *Local Area Connection Status* dialog box will open.

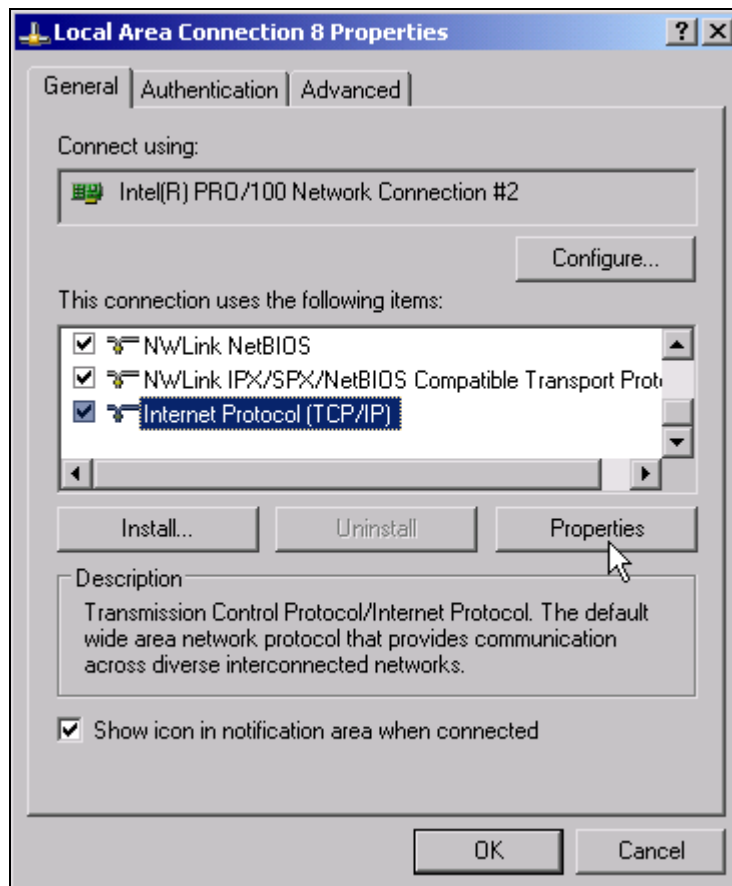


**Note**

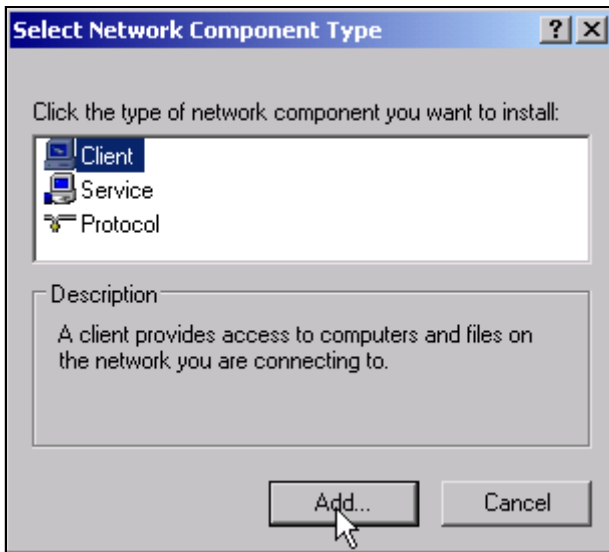
- Windows XP automatically appends numbers to the name Local Area Connection Status (e.g. Local Area Connection Status 8) if the configuration is created using the New Connection wizard. Since these numbers are unimportant in the following configuration steps, they are omitted in the description.
- Alternatively it is possible to access the dialog using a connected external keyboard. Proceed as follows:
Open the Windows XP Start menu with the Windows key or *CTRL+ESC*. Select *Settings - Network Connections - Local Area Connection*. The Local Area Connection Status dialog box will open.

➤ Click the *Properties* button.

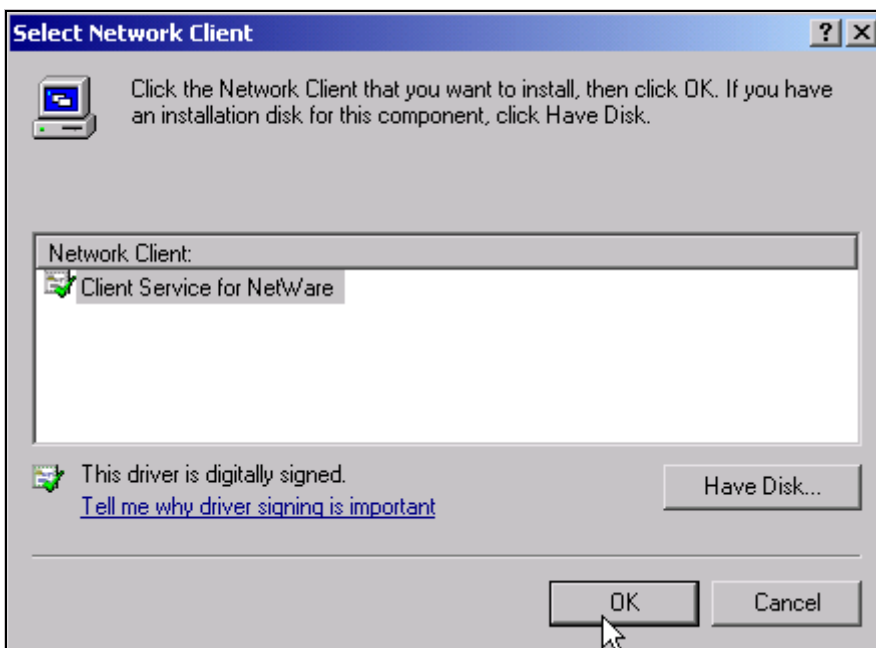
The dialog box containing the available network protocols will open.



- Click the *Install* button.
The list of available network components will open.

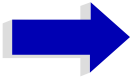


- Select *Client*.
- Click the *Add...* button.
The list of available network protocols will open.



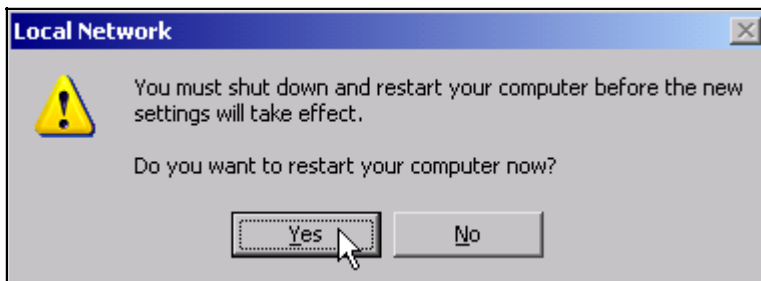
- Select *Client Service for NetWare*.

- Click the *OK* button.
The network driver for Novell Netware will be installed.

**Note**

- Your network administrator knows which clients, services and protocols must be installed for your network.
 - If network components not contained in *D:\I386* need to be installed, e.g. a memory stick containing the drivers must be prepared (or a CD that is replayed via a USB CD-ROM drive).
In this case, click the *Have Disk* button and specify the path with the corresponding drivers.
-

After you complete the installation, you will be prompted to restart the instrument.



- Click the *Yes* button.
Windows will restart the system.

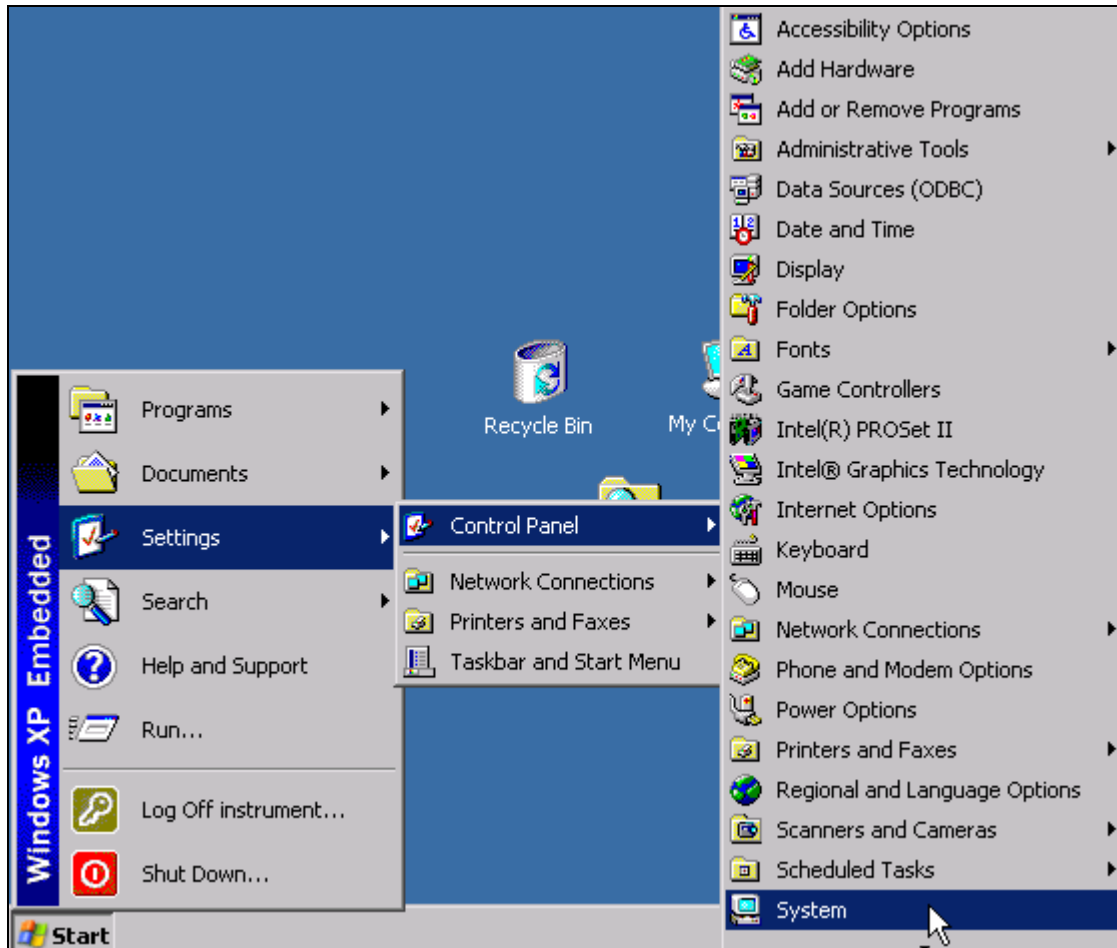
Configuration Examples

Network	Protocols	Services	Comments
NOVELL Netware	NWLink IPX/SPX compatible transport	Client service for NetWare	The frame type used in the network must be set under <i>Protocols - Properties</i> .
IP Networks (FTP, TELNET, WWW, GOPHER, etc.)	TCP/IP	Simple TCP/IP services	An IP address that is unique in the network must be set under <i>Protocols - Properties</i> .
MICROSOFT Network	TCP/IP	Workstation server	A name that is unique in the network must be set under <i>Identification - Computer Name</i> .

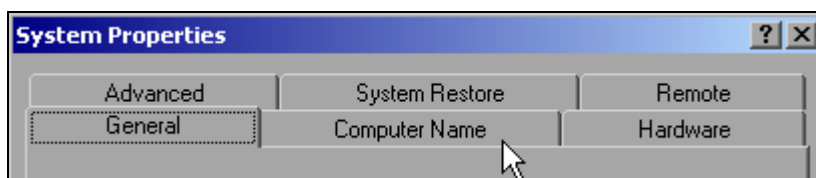
Subsequent Changes to the Network Configuration (Computer Name, Domain, Workgroup, etc.)

After completing the installation, you can modify the computer name as follows:

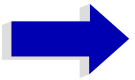
- Press the Windows key or **CTRL+ESC**.
The Windows Start menu will open.



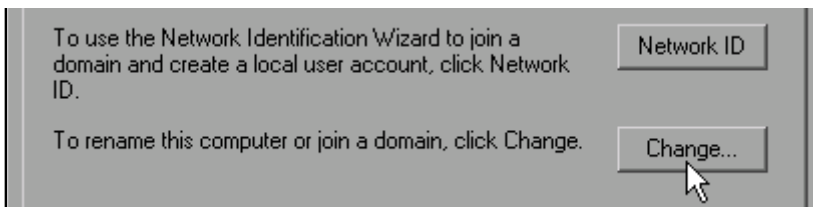
- Select Settings - Control Panel - System.
The *System Properties* dialog will open.



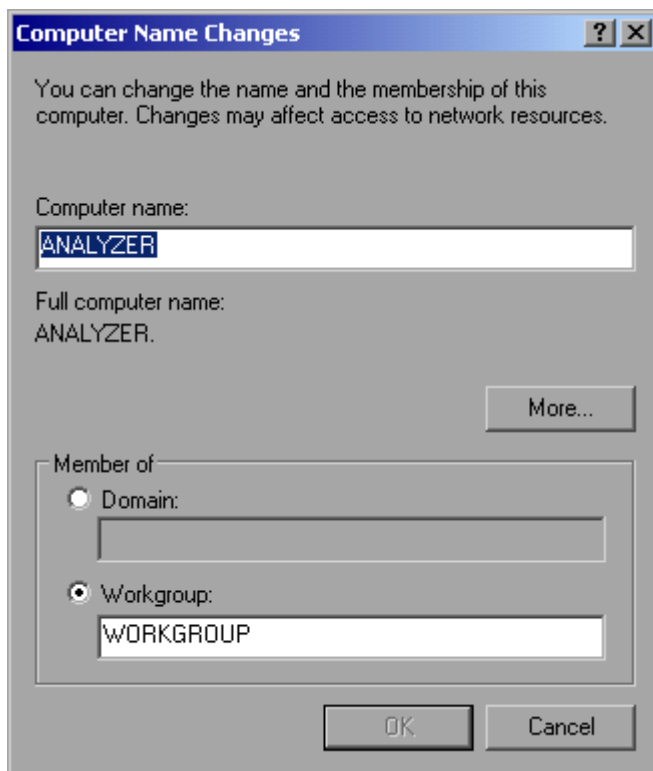
- Select the *Computer Name*.

**Note**

You can change the other settings after you select the other tabs. Before doing so, however, be sure to check with your network administrator.



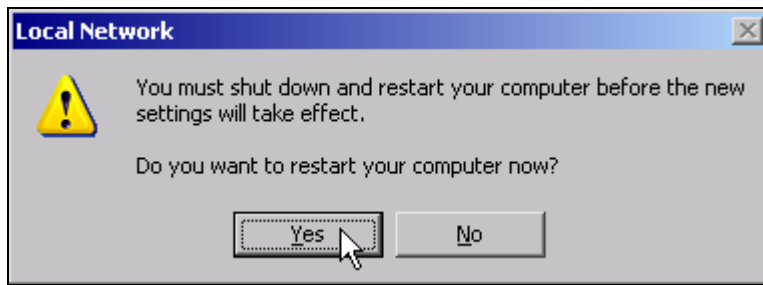
- Click the *Change* button.
The dialog box for changing the computer name, domain and workgroup will open.



- Enter a new computer name.
- If necessary, enter a *Domain* or *Workgroup*.

- Confirm changes with *OK*.

You are prompted to restart the instrument:



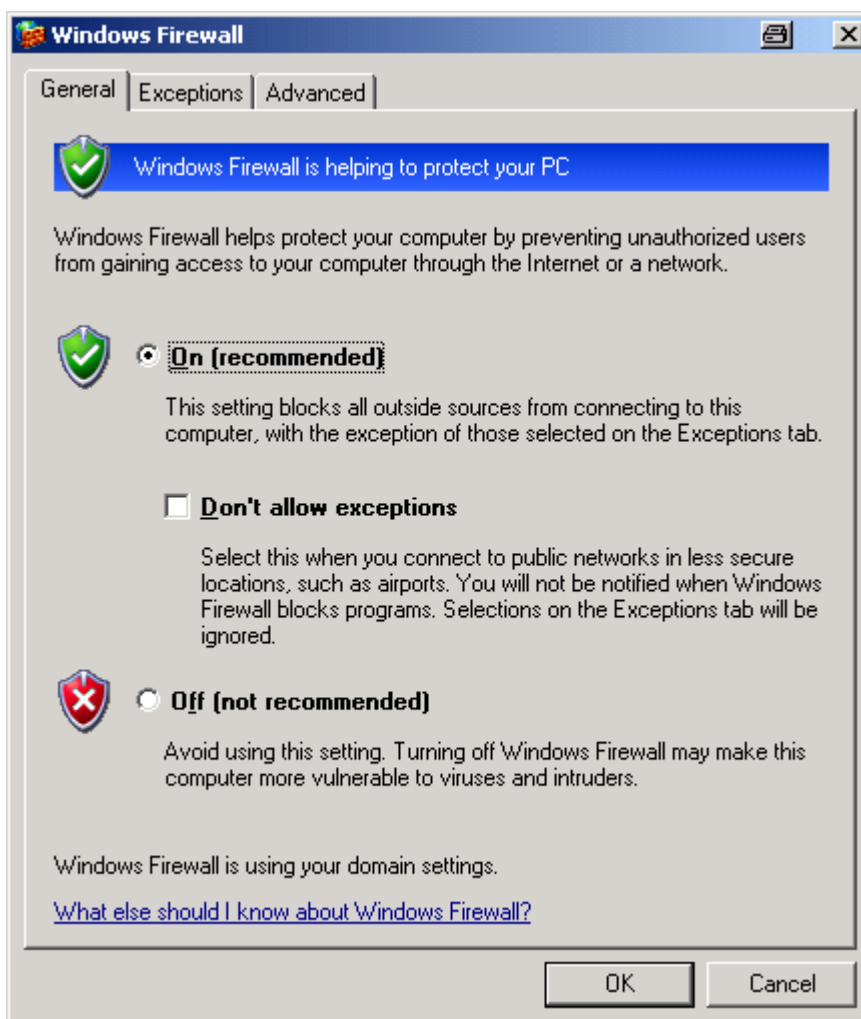
- Click the *Yes* button.
Windows will restart the system.

Configuring the Windows XP Firewall

The Windows XP Firewall blocks all network communication which is not initialized by the controller itself or which is defined as unwanted. It protects the controller from an attack of hostile users and programs. On the instrument, the Internet Connection Firewall (ICF) is activated for all network connections by default to enhance protection of the instrument.

The default configuration of the firewall enables data transfer with other controllers in a local network, file and printer sharing and remote control via LAN. To change these settings for security reasons, perform the following steps:

- Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.
- Click *Settings* and then *Control Panel* and *Windows Firewall*. The *Windows Firewall* dialog box is displayed.



Operating the Instrument without a Network

If you want to operate the instrument either temporarily or permanently without a network connection, no special measures are necessary in contrast to Windows NT. Windows XP automatically detects the interruption of the network connection and does not set up the connection when the instrument is switched on.

If you are not prompted to enter the user name and password, proceed as described in the section [“Reactivating the Automatic Login Mechanism”](#) on page 6.16.

Operating the Instrument in a Network

After network support has been installed, data can be exchanged between the instrument and other computers, and network printers can be used.

Network operation is possible only if you are authorized to use network resources. Typical resources are file directories of other computers or even central printers.

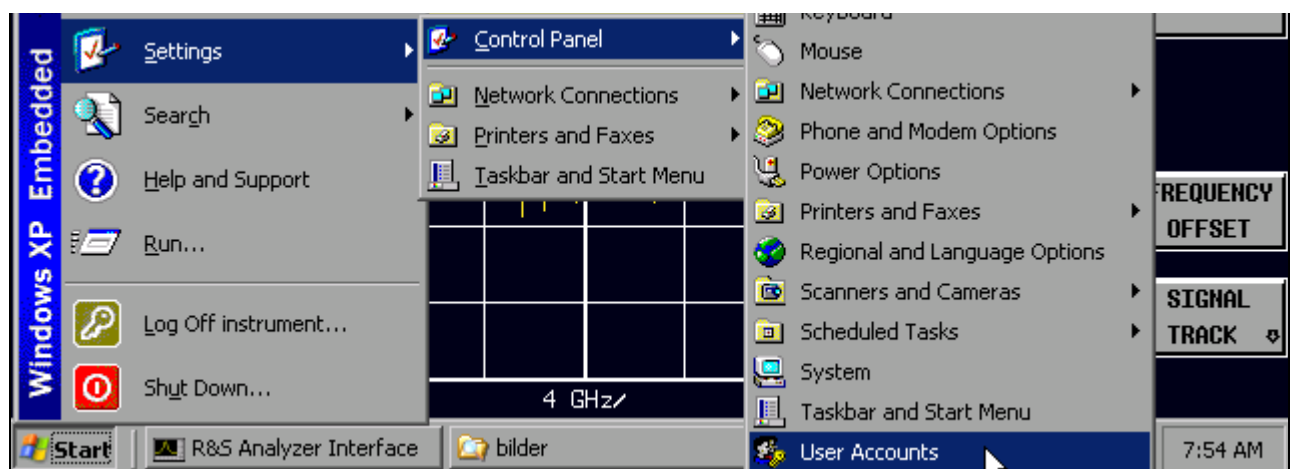
Authorization is assigned by the network or server administrator. This requires having the network names of the resources and the corresponding authorizations.

Creating Users

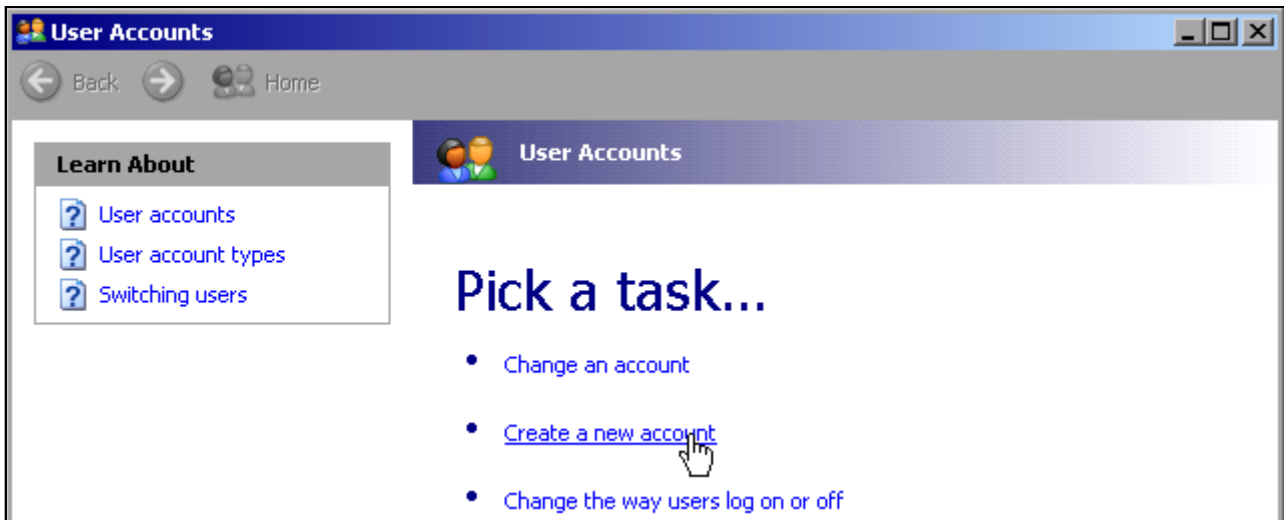
After the software for the network has been installed, the instrument will issue an error message the next time it is switched on, because there is no user named *instrument* (= user ID for Windows XP automatic login) in the network. Thus, a matching user must be created in Windows XP and in the network, the password must be adapted to the network password, and the automatic login mechanism must then be deactivated.

The network administrator is responsible for creating new users in the network. A new user can be created on the instrument by using the User Account wizard:

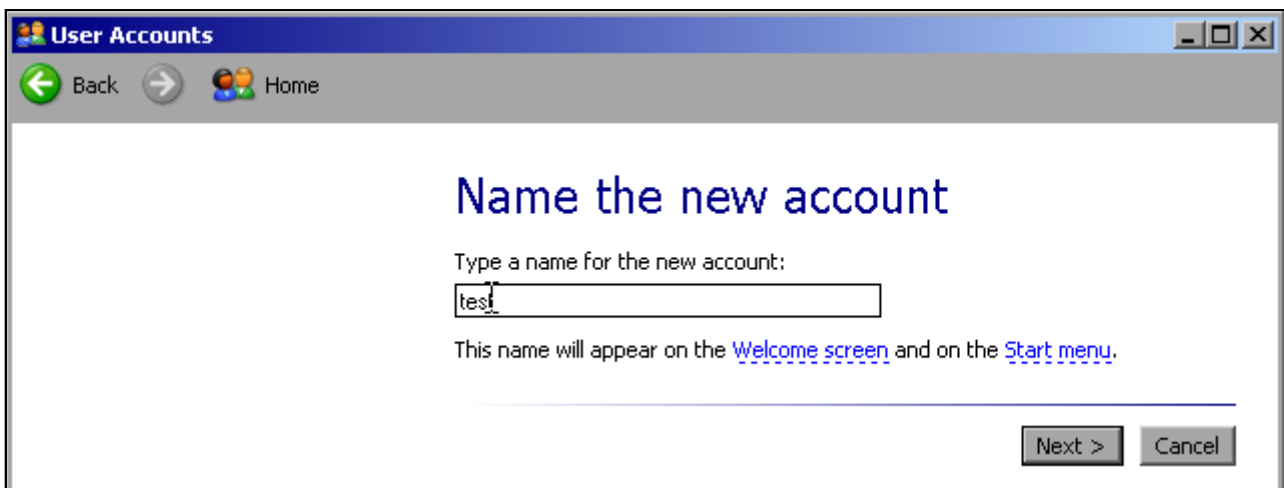
- Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.



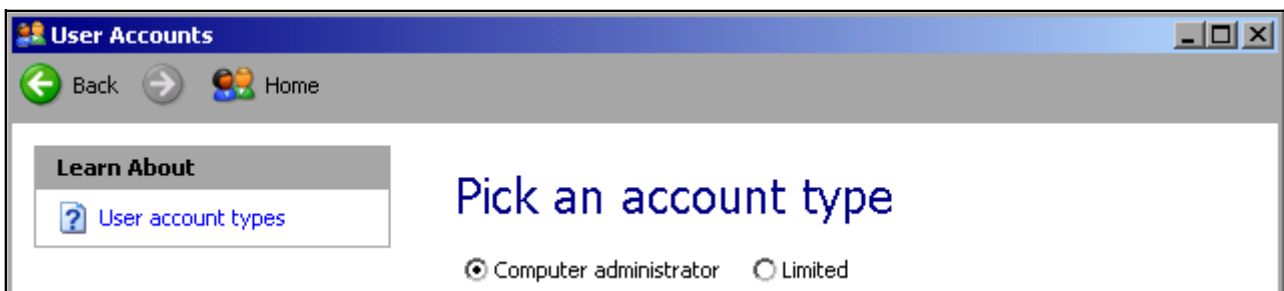
- Click *Settings* and then *Control Panel* and *User Accounts*.
The wizard for managing the user will open with the *Pick a task...* dialog box.



- Select *Create a new account*.
The dialog box for entering a new computer name will open.



- Enter the name of the new user in the text field and confirm with *Next ->*. The *Pick an account type* dialog box for defining the user's rights will open.



- Select *Computer administrator*.



Note

Proper firmware function requires administrator rights.

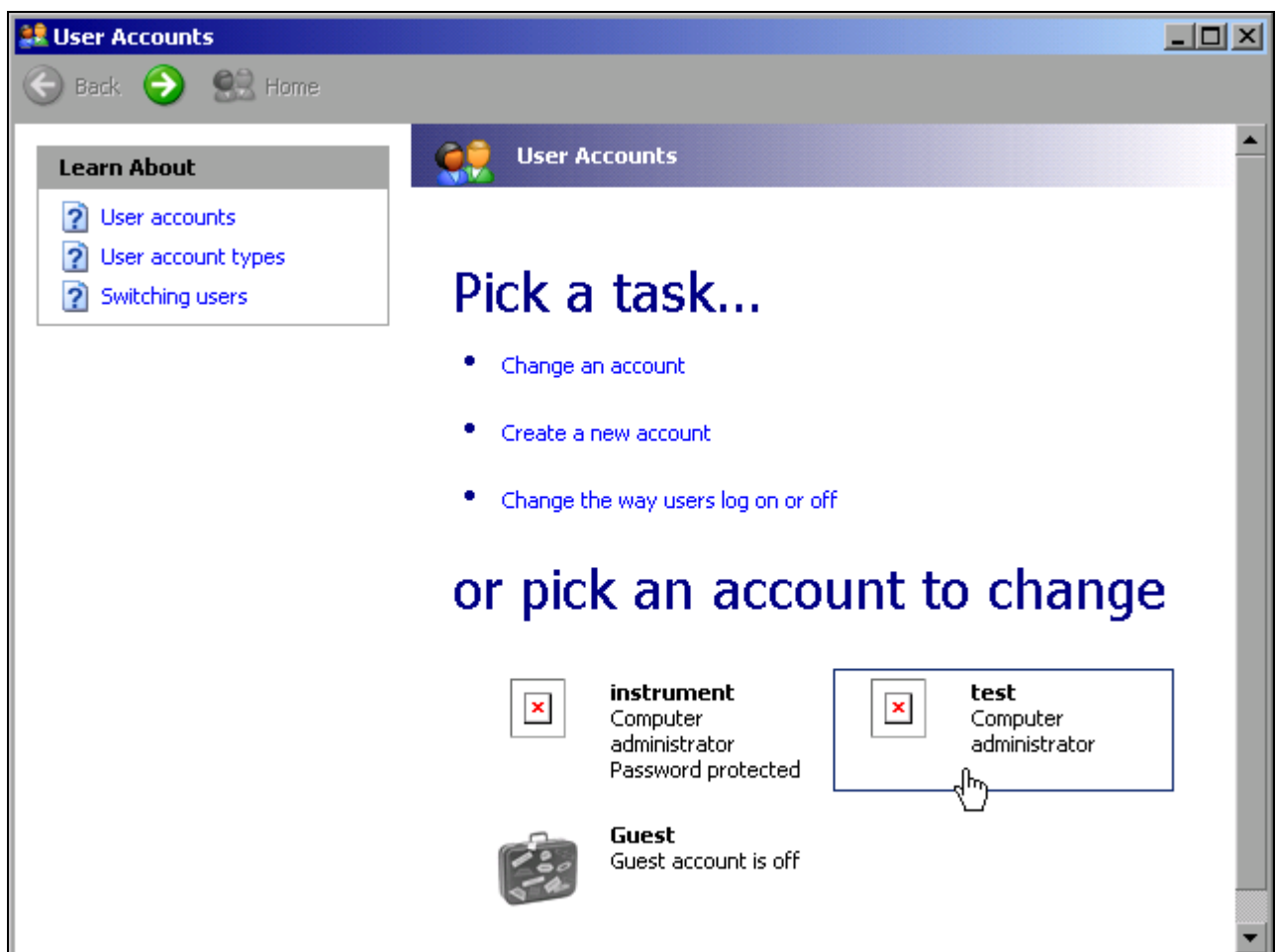


- Conclude the creation of the new user by clicking the *Create Account* button. The new user has now been created.

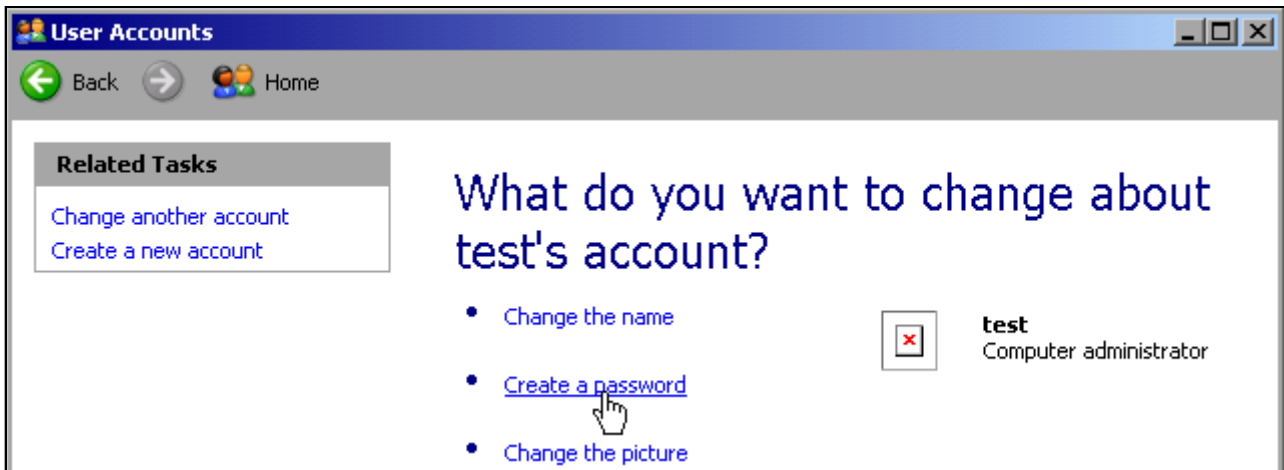
Changing the User Password

After the new user has been created on the instrument, the password must be adapted to the network password. This is also done by using the User Account wizard.

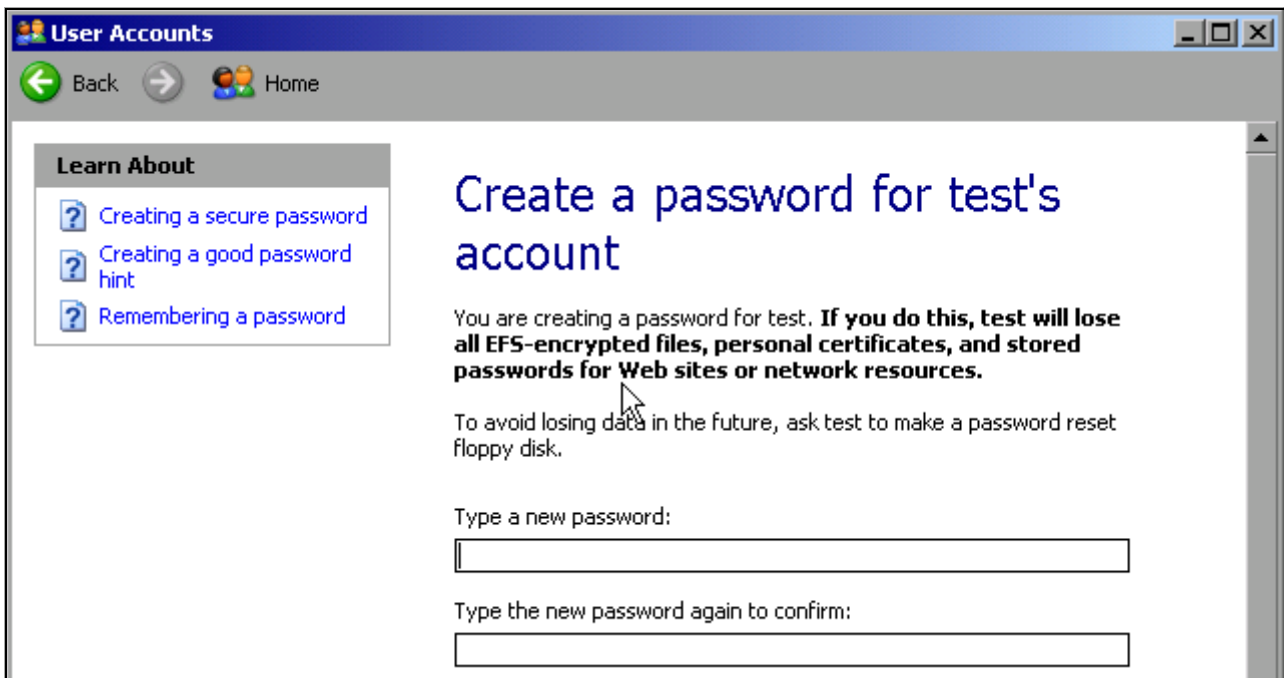
- Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.
- Click *Settings* and then *Control Panel* and *User Accounts*. The wizard for managing the users will open with the *Pick a task...* dialog box.



- Click the desired user account (in the example: user *Test*). The dialog box for selecting the desired action will open.



- Click *Create a password*.
The dialog box for entering a new password will open.



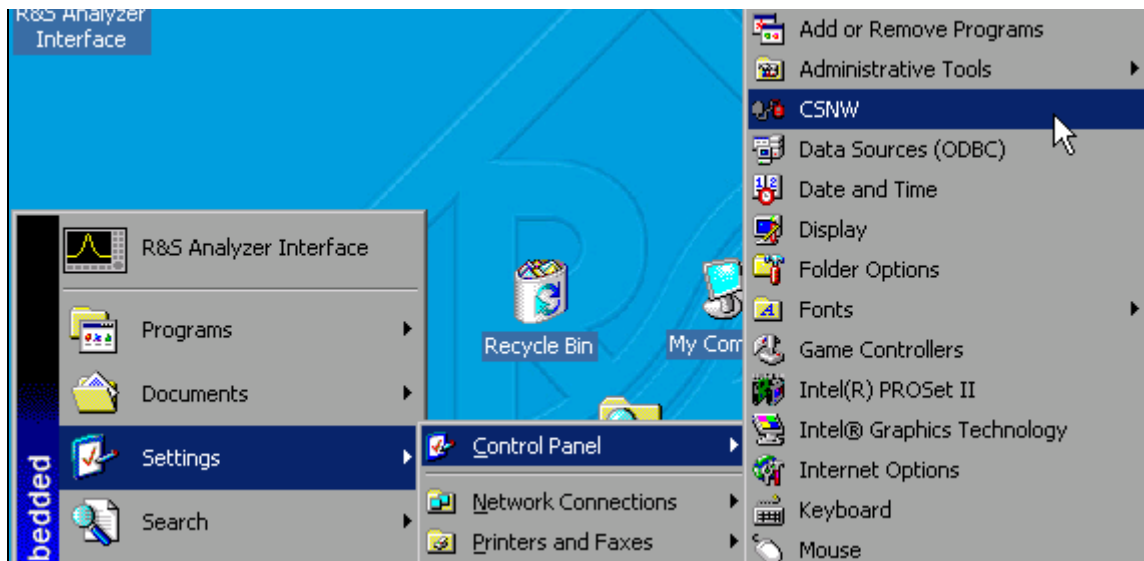
- Enter the new password in the upper text line and repeat it in the following line.
- Scroll the screen contents down.



- Conclude the entry with the *Create Password* button.
The new password is now active.

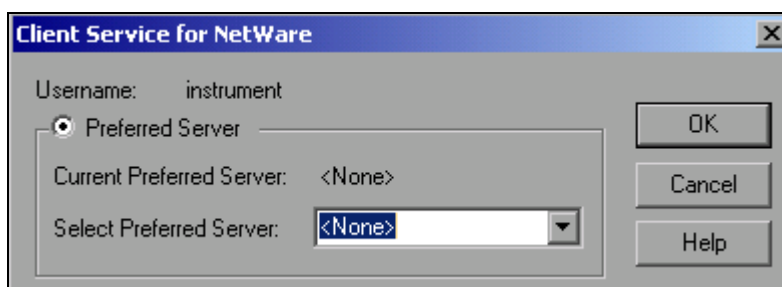
NOVELL Network only: Configure NOVELL Client

- Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.



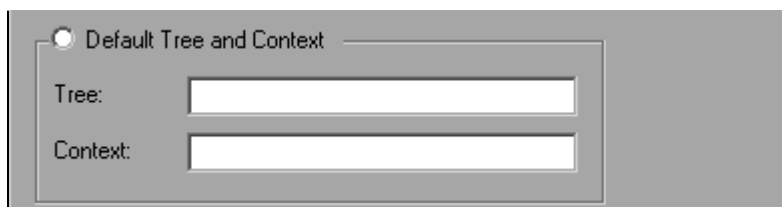
- Click *Settings* and then *Control Panel* and *CSNW*.

Bindary Login (NOVELL 3.x)



- Click *Default Tree and Context*.
- Under *Select Preferred Server*, select the NOVELL server on which the user has been created.

NDS Login (newer NOVELL versions)



- Click *Default Tree and Context*.
- Under *Tree*, enter the NDS Tree and, under *Context*, the hierarchical path on which the user has been created.

- If desired, click the *Run Login Script* entry.

**Note**

You can obtain this information from your network administrator.

- Conclude the login configuration with *OK*.

Logging On to the Network

Network login occurs at the same time you log on to the operating system. For this to be possible, the user name and the password must be identical under Windows XP and on the network.

Deactivating the Automatic Login Mechanism

When shipped, the instrument is already configured to automatically log on under Windows XP. To deactivate the automatic login mechanism, perform the following steps:

- Open the Windows XP Start menu with *CTRL+ESC*.
- Select *RUN* from the menu.
An entry field will open.
- Enter the command *D:\USER\NOAUTOLOGIN.REG* in the entry field and confirm it with *ENTER*.

The automatic login mechanism will be deactivated. The next time you switch on the instrument, you will be prompted to enter your user name and password before the firmware is started.

Reactivating the Automatic Login Mechanism

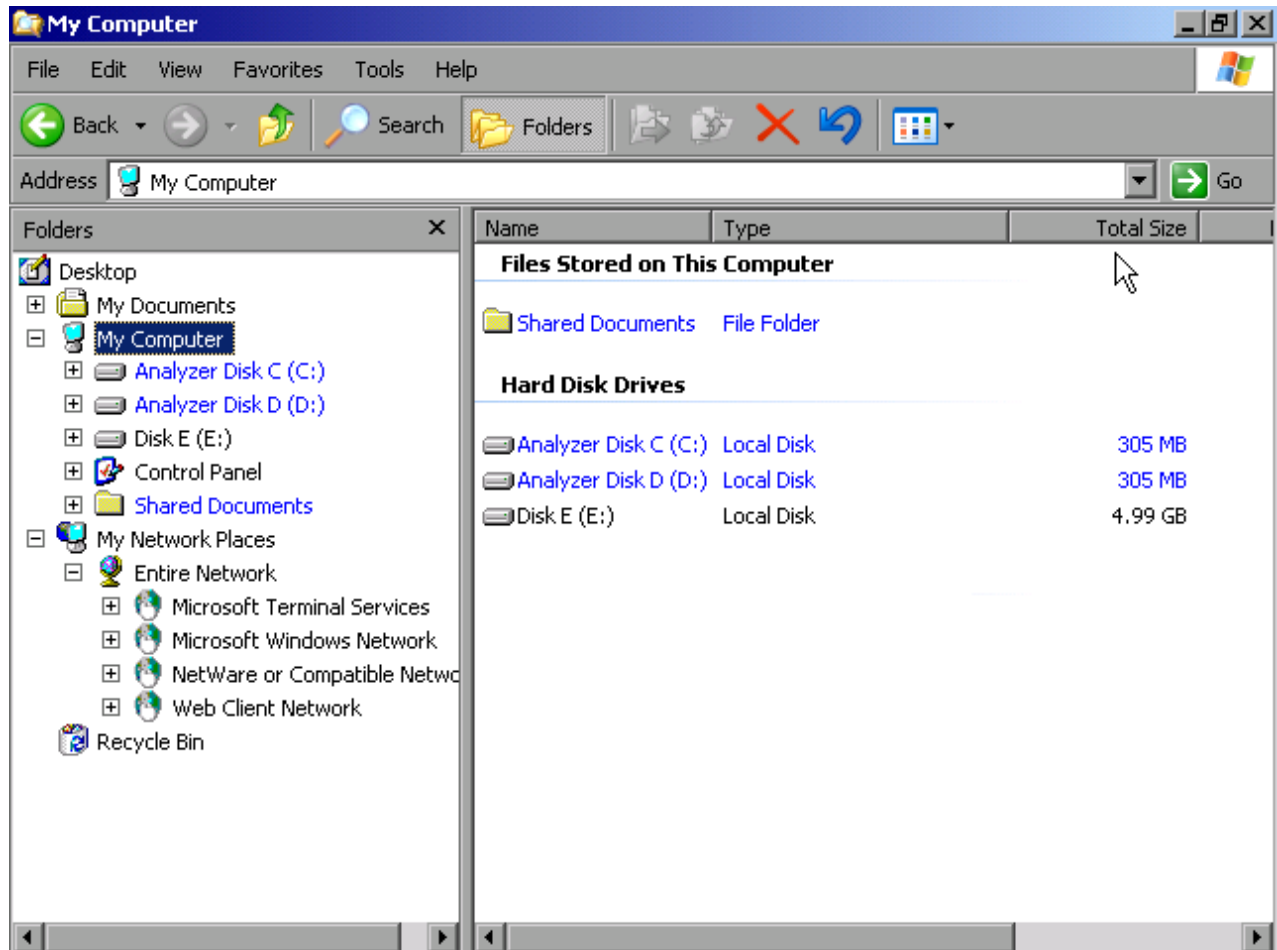
To reactivate the automatic login mechanism, do the following:

- Open the Windows XP Start menu with *CTRL+ESC*.
- Select *RUN* from the menu. The entry field will open.
- Enter the command *D:\USER\AUTOLOGIN.REG* in the entry field and confirm it with *ENTER*.

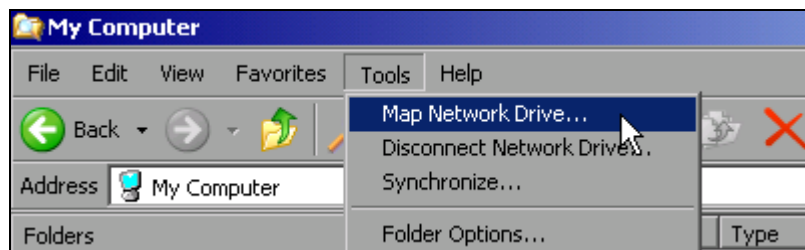
The automatic login mechanism will be reactivated,. It will be applied the next time the instrument is switched on.

Using Network Drives

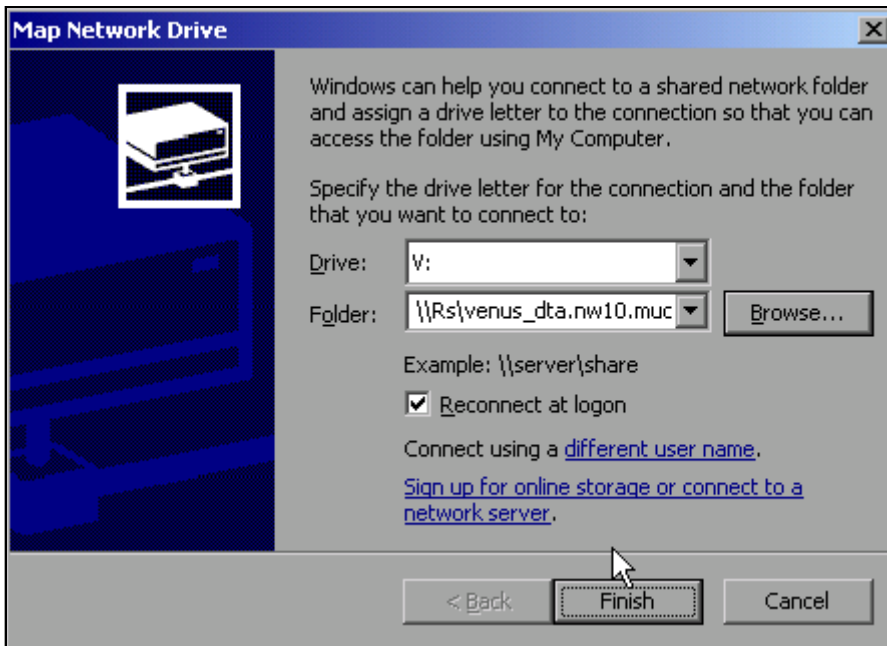
- Using the Windows key or the key combination *CTRL+ESC*, call the Windows XP Start menu.
- Click *Programs*, and then *Accessories* and *Windows Explorer*.
- Under Desktop, click *My Network Places* and *Entire Network*
All available network drives will be displayed.



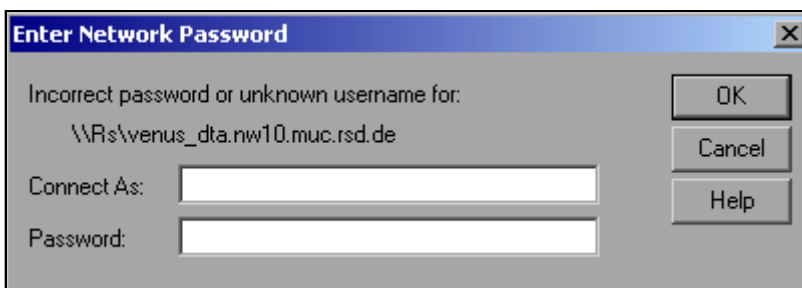
- Click *Tools* and then *Map Network Drive*.



The *Map Network Drive* dialog will open:



- Under *Drive*: click the drive.
- Using *Browse*, open the list of network paths available in the network.
- Mark the desired network path.
- Activate *Reconnect at Logon*: if you want the connection to be set up automatically each time the instrument is started.
- Click *Finish* to connect the network path with the selected drive. You will be now prompted to enter your user name and password.



The drive will then appear under *All Directories* in Explorer.



Note

Only networks authorized in the network will be connected.

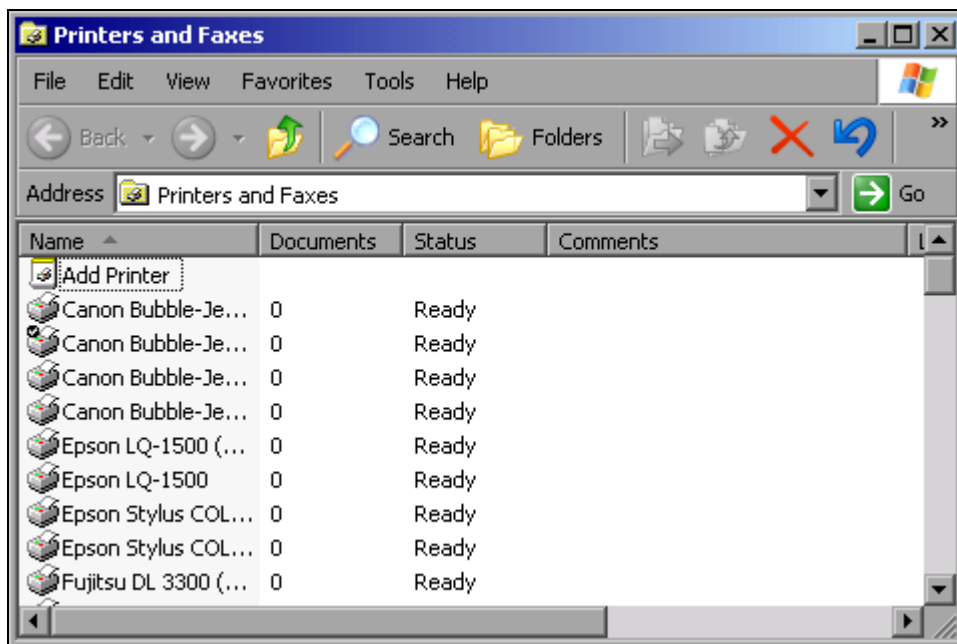
Terminate the connection

- In Windows Explorer, click *Tools* and then *Disconnect Network Drive*.
- Under *Drive:*, select the drive whose connection is to be terminated.
- Click *OK* to terminate the connection. You will need to confirm this step with *Yes*.

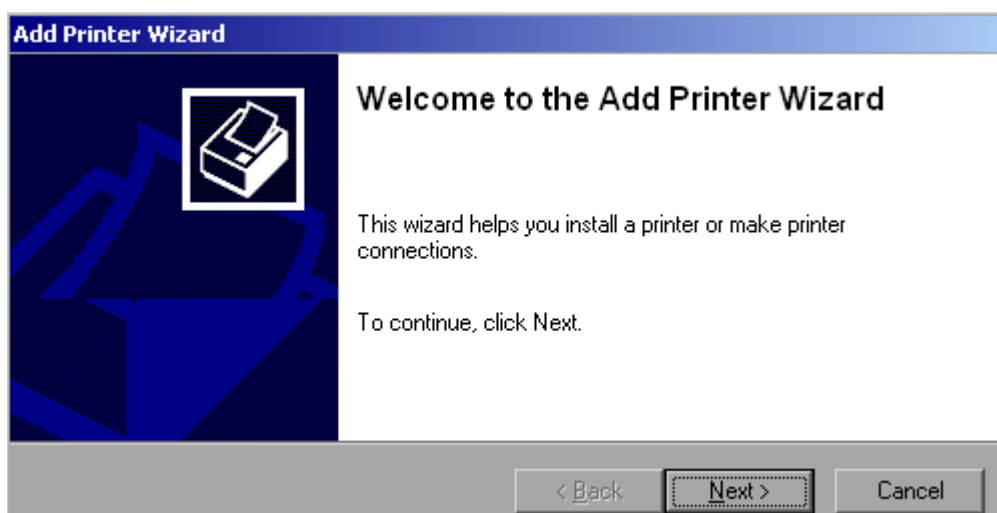
Installing a Network Printer

A new printer is installed using the *INSTALL PRINTER* softkey in the *HCOPY* menu.

- Click the *HCOPY* key.
The *HCOPY* menu will open.
- Click the *NEXT* key to go to the side menu.
- Using *INSTALL PRINTER*, open the *Printers and Faxes* dialog box

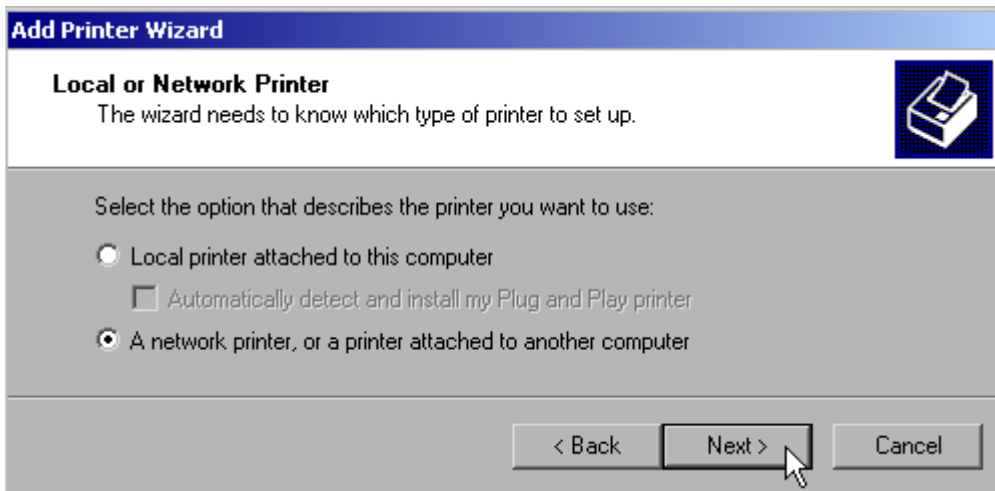


- Using the rotary knob, go to Add Printer in the selection list.
- Using right arrow key, mark the entry and then confirm by pressing *ENTER* or the rotary knob.
The *Add Printer Wizard* will now appear.

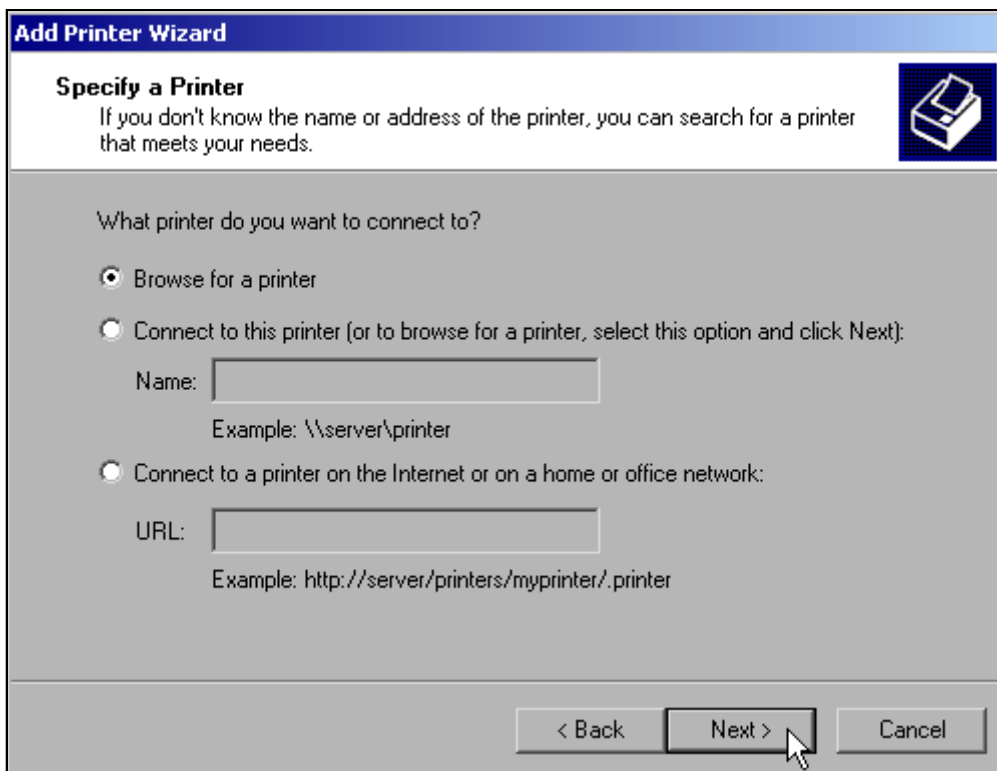


- Select *Next* with the rotary knob and then press the rotary knob to confirm. The *Local or Network Printer* selection will appear.

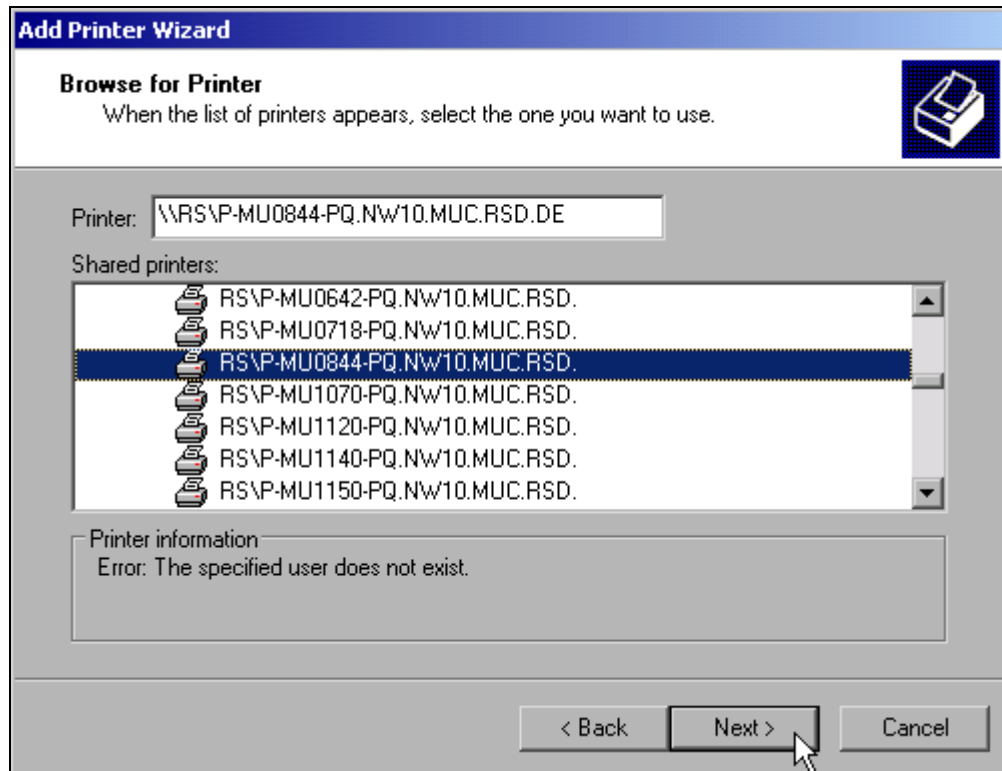
In this example, an HP Laserjet 5 printer is installed as a network printer.



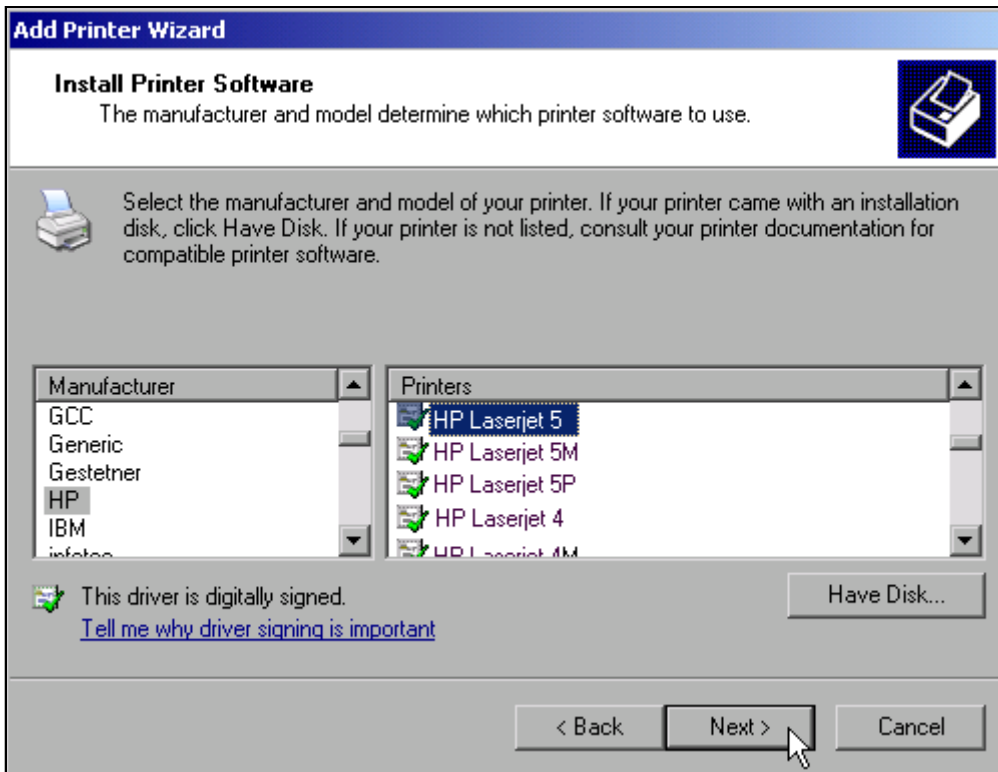
- To select a network printer, activate *A network printer or a printer attached to another computer*.
- Click *Next* to continue. The *Specify a Printer* dialog will open.



- Click *Browse for a printer* and then *Next*.
The selection of enabled printers will appear.



- Mark a printer and confirm with *OK*.
- When you are prompted to confirm the installation of a suitable printer driver, click *OK*.
The selection of printer drivers will appear.
The left-hand pane will list the manufacturers and the right-hand pane the available printer drivers.



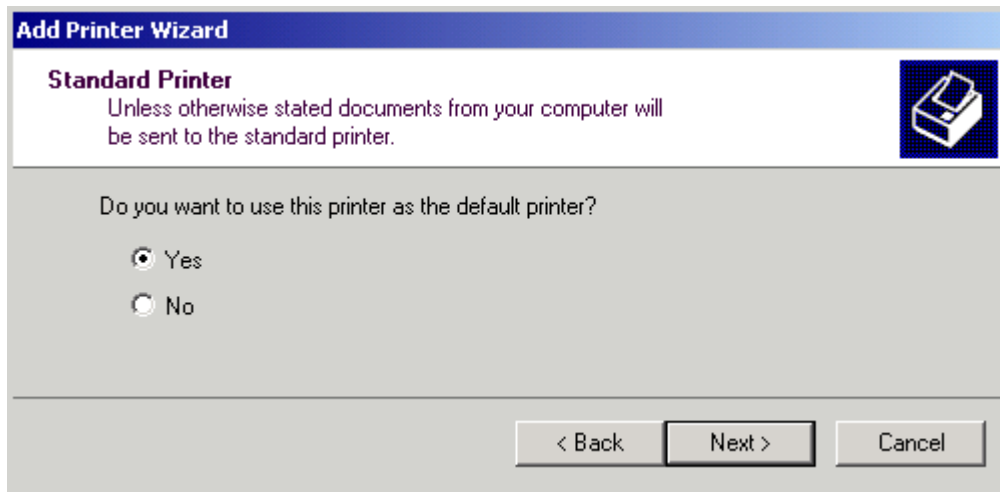
- Select the appropriate manufacturer under *Manufacturers* and then the appropriate printer driver under *Printers*.



Note

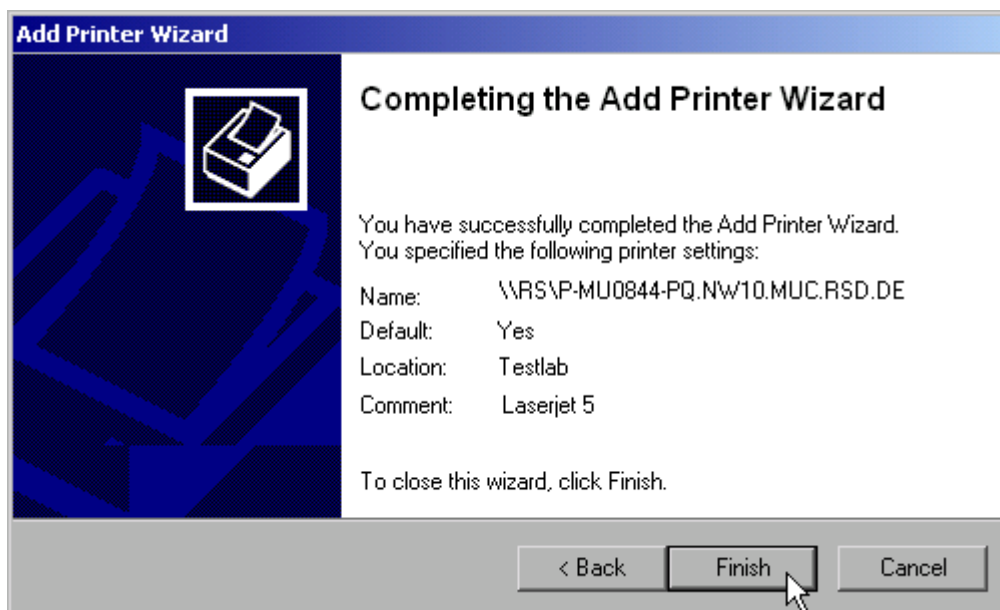
If the printer you need does not appear in the list, the driver has not yet been installed on the instrument. In this case, click the *Have Disk* button. You will then be prompted e.g. to connect a memory stick containing the required driver. Then press *OK* and select the printer driver.

- Click *Next*.
The default printer selection dialog is opened.



If one or more printers have already been installed, you will now be asked whether you want to use the printer you just installed as the default printer for Windows XP applications. The default response is *No*.

- After selecting the default printer, click *Next*. The final message of the installation wizard is displayed.



- Click the *Finish* button to start installation of the printer driver.

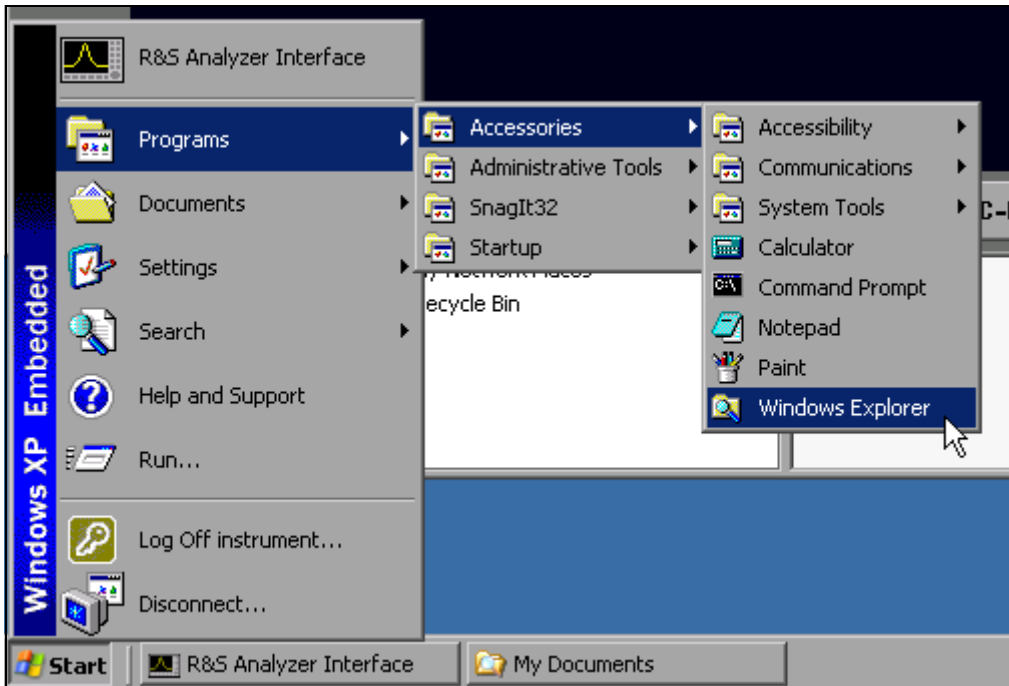
The instrument must then be configured for printout with this printer using the *DEVICE SETUP* and *DEVICE 1/2* softkeys in the hardcopy main menu (see section “[Selecting and Configuring Printers](#)” on page 2.17).

Sharing Directories (only with Microsoft Networks)

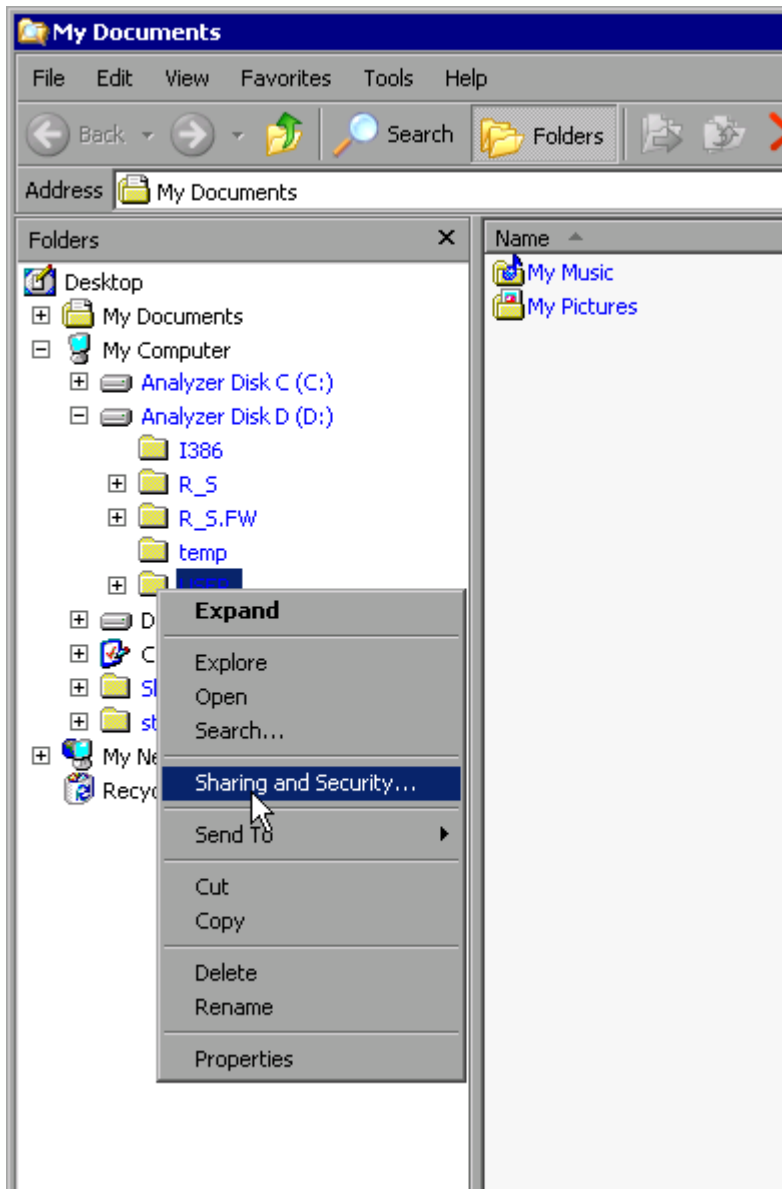
Sharing directories makes data on the device available for use on other computers. This is possible only in Microsoft networks.

Sharing is a property of a file or directory. The procedure for applying sharing is as follows:

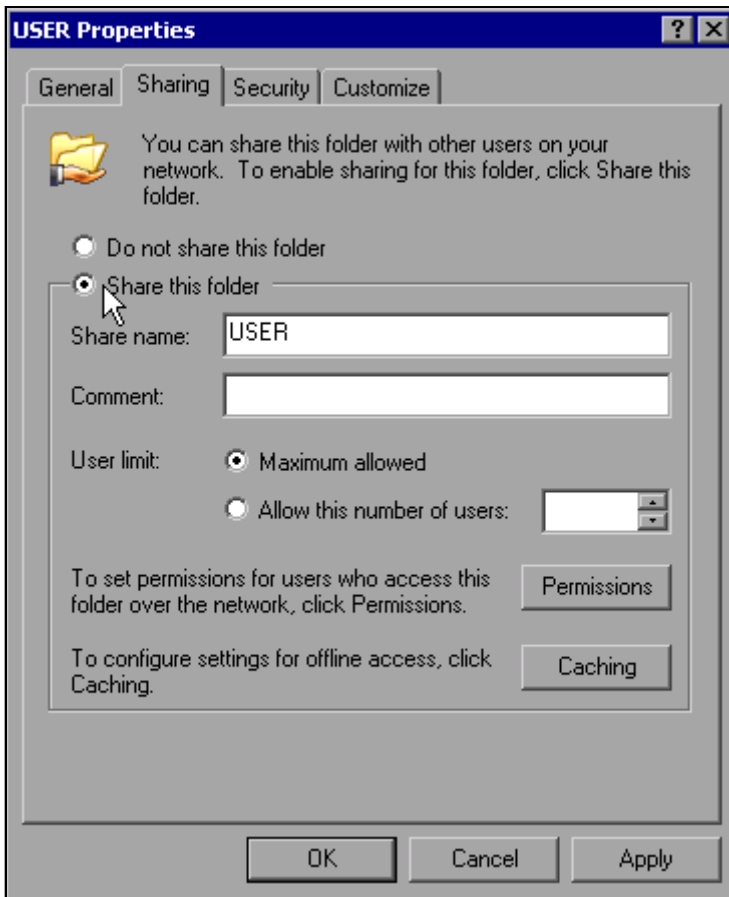
- Open the Windows Start menu with the Windows key or *CTRL+ESC*.



- Click *Programs - Accessories - Windows Explorer* to open Windows Explorer.



- Click the desired folder with the right mouse button.
- Click *Sharing and Security*.
The dialog for sharing the directory will open.



➤ Click *Share this folder*.

➤ You can change the following settings as necessary:

Share name: Name under which the directory appears in Explorer

Comment: Comments regarding the shared directory

User Limit: Maximum number of users who can access the directory simultaneously

Permissions: The user access rights (read only, read and write, all)

Caching: Local buffering of the directory contents for quicker access

➤ Confirm the settings with *OK*.

The drive will be shared and marked with a hand under the directory symbol in Explorer:



Manual Operation of the R&S FMU with XP Remote Desktop

Introduction

In production test and measurement, a common requirement is central monitoring of the T&M instruments for remote maintenance and remote diagnostics. Equipped with the Remote Desktop software of Windows XP, the R&S FMU ideally meets requirements for use in production:

- Access to the control functions via a virtual front panel (*soft front panel*)
- Printout of measurement results directly from the controller
- Storage of measured data on the controller's hard disk

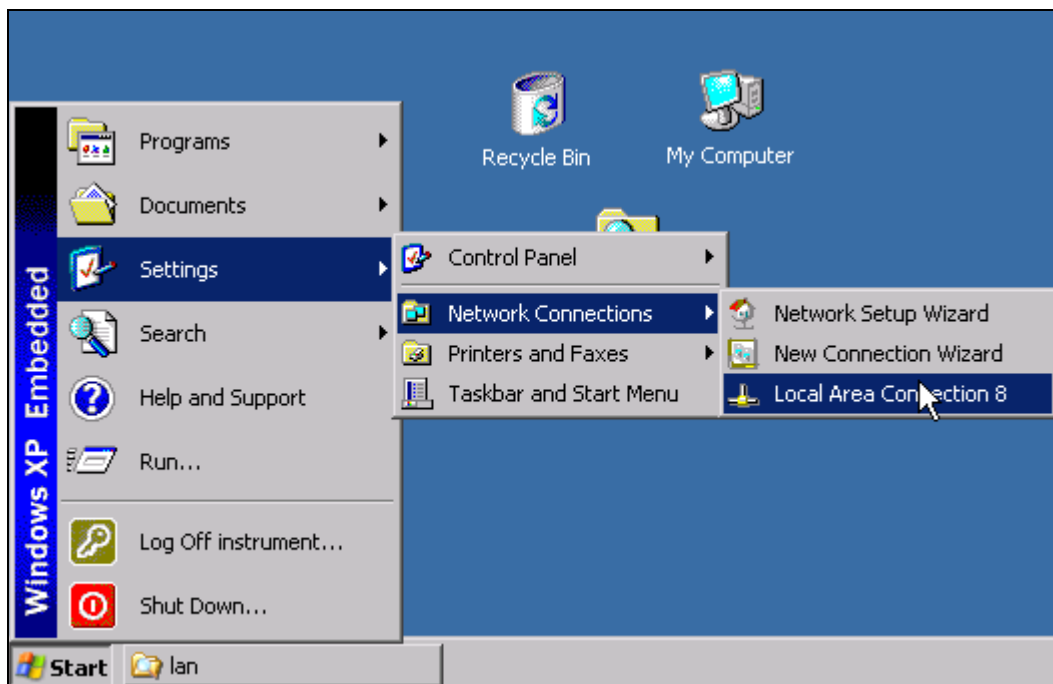
The R&S FMU is connected via a LAN, in which case Windows XP also supports a connection via a modem. This section describes the configuration of the R&S FMU and Remote Desktop Client of the control PC. Details on how to set up a modem connection are described in the Window XP documentation.

Configuring the R&S FMU for Use of XP Remote Desktop

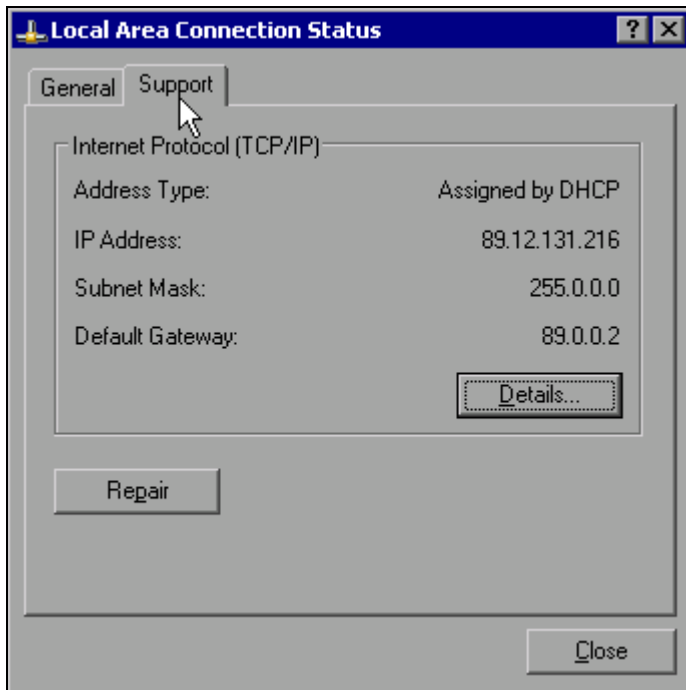
To enable an external computer to access the Remote Desktop software of the R&S FMU, proceed as follows:

1. Determine the IP configuration of the network connection:

- Open the Windows XP Start menu with the Windows key or the *CTRL+ESC* key combination.



- Click *Settings - Network Connections - Local Area Connection*. The *Local Area Connection Status* dialog box will open.



- Click the *Support* tab. The current TCP/IP configuration will be displayed.

If *Assigned by DHCP* appears in the *Address Type* field, go to step 2 (Create a fixed IP address...). Otherwise, simply note the IP address and go to step 3 (Enable the R&S FMU...).

2. Create a fixed IP address for the TCP/IP protocol as described in the section [“Configuring Existing Network Protocols \(TCP/IP Protocol\)”](#) on page 2.23

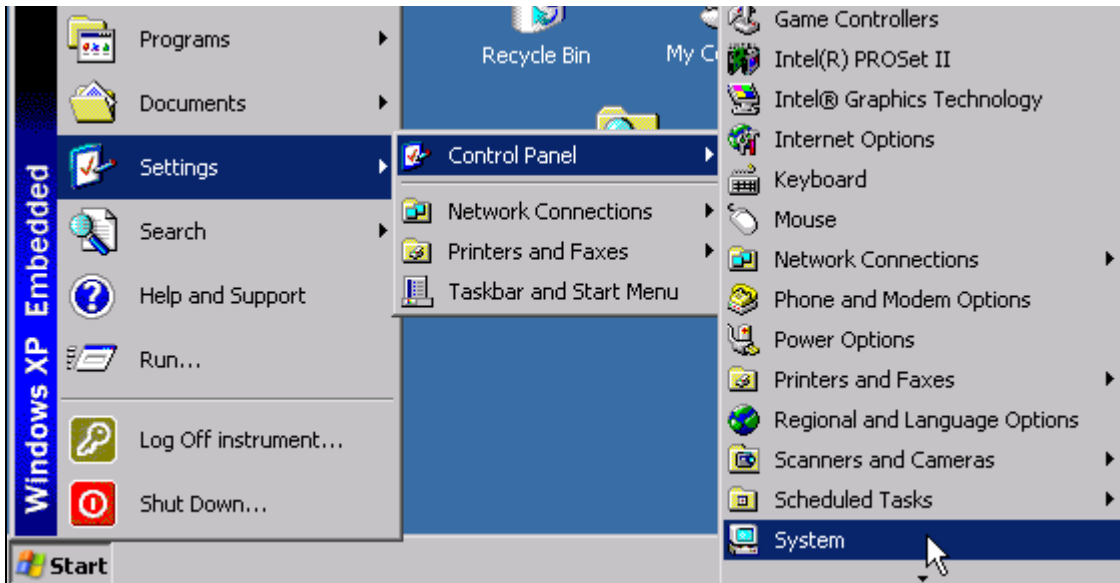


Note

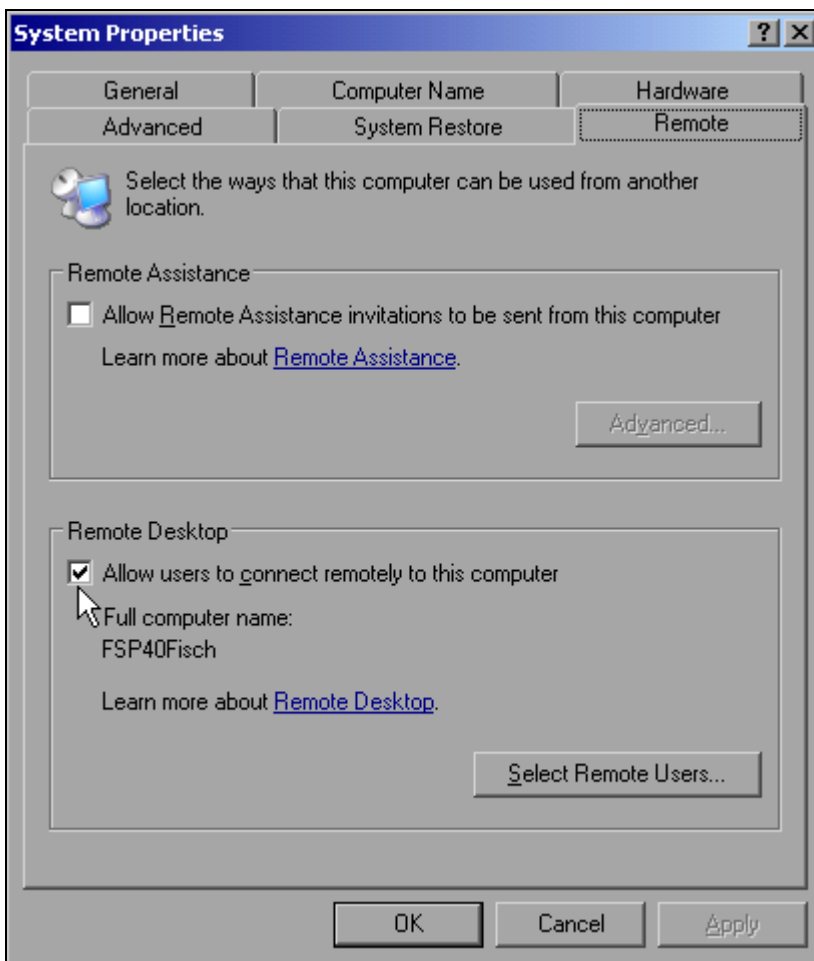
To avoid problems, use a fixed IP address. When a DHCP server is used, a new IP address is assigned each time the instrument is restarted. This address must first be determined on the instrument itself. Thus, using a DHCP server is not suitable for remote operation of the R&S FMU.

3. Enable the R&S FMU for operation with Remote Desktop

- Press the Windows key or *CTRL+ESC*.
The Windows Start menu will open.



- Select *Settings - Control Panel - System*.
- Select the *Remote* tab.



- In the *Remote Desktop* panel, select the check box in front of *Allow users to connect remotely to this computer*.
- If necessary, click *Select Remote Users...* and select users created on the R&S FMU who are to be given access to the R&S FMU also via Remote Desktop.

**Note**

The user account under which configuration is carried out is automatically enabled for Remote Desktop.

- Confirm the setting with *OK*.

The R&S FMU is now ready for connection setup with the Remote Desktop program of the controller.

Configuring the Controller

Before Remote Desktop can be operated, the TCP/IP protocol must be created on the controller and Remote Desktop Client must be installed.

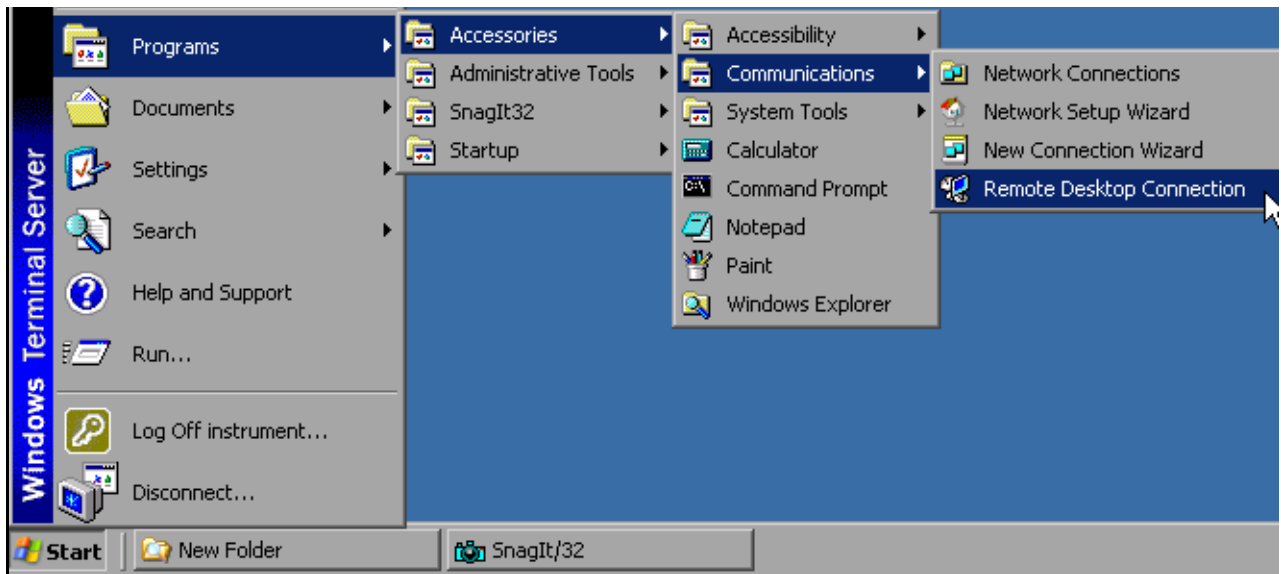
**Note**

With Windows XP, Remote Desktop Client is part of the operating system and can be accessed via *Start - Programs - Accessories - Communications - Remote Desktop Connection*.

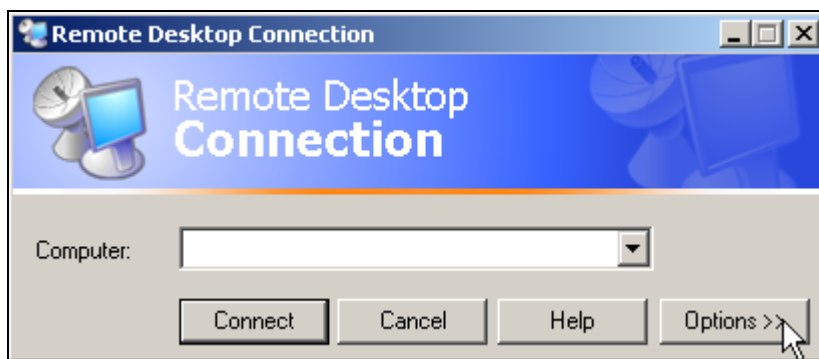
For other versions of Windows, Microsoft offers the Remote Desktop Client as an add-on.

The settings on the Remote Desktop Client of the controller must be made before the connection with the R&S FMU is set up. The procedure is as follows:

➤ Press the Windows key or *CTRL+ESC*.



➤ Select *Programs - Accessories - Communications - Remote Desktop Connection*. The Remote Desktop login screen will appear.

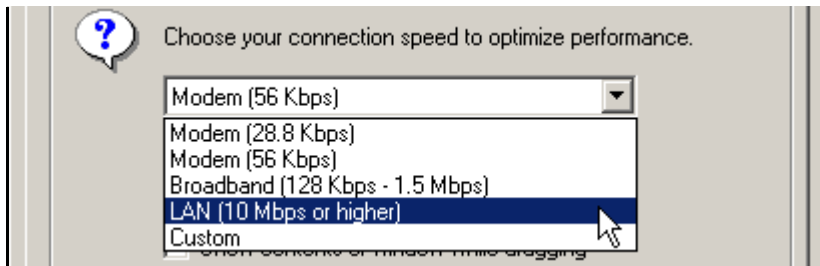


➤ Select the *Options >>* button. The table with the configuration data will appear.

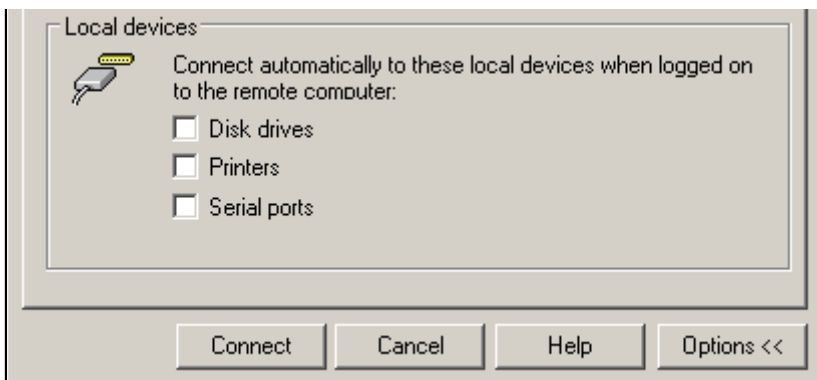


➤ Select the *Experience* tab. These settings are used to select and optimize the connection speed.

- Click the selection list under *Choose your connection speed to optimize performance*. The list of available configurations will appear.



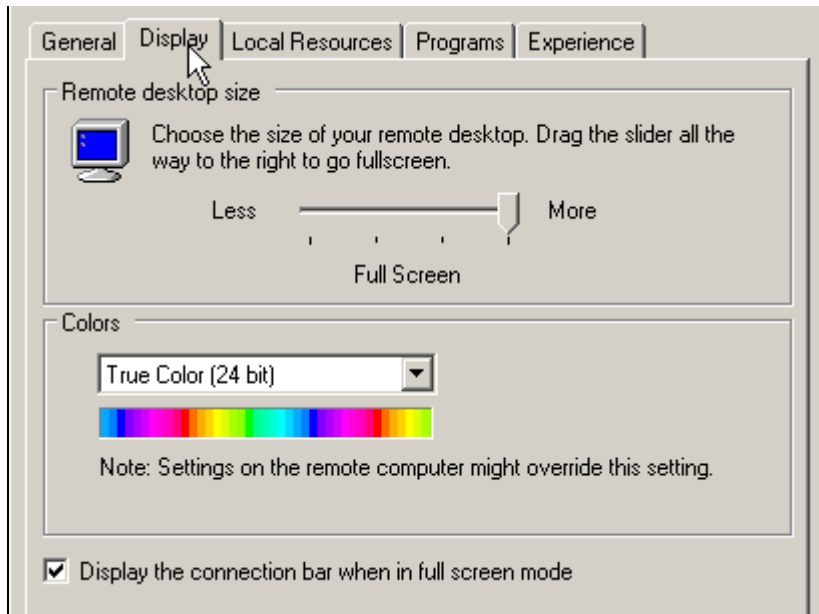
- Select the appropriate connection (for example: LAN (10 Mbps or higher)). Depending on your selection, various checkboxes will be activated in the list located below (also depends on how powerful the connection is).
- To improve performance, you can deactivate *Desktop background*, *Show Contents of Window while dragging* and *Menu and Window animation*.
- Click the *Local Resources* tab. The tab for enabling printers, local drives and serial interfaces will appear.
- Click the check box in front of *Disk drives* if you will need to access drives of the controller from the R&S FMU (e.g. in order to store settings or to copy files from the controller to the R&S FMU):



Windows XP will then map drives of the controller to the R&S FMU like network drives.

- Click the check box in front of *Printers* if you want to use printers connected to the controller by accessing them from the R&S FMU.
- Do not change the remaining settings.

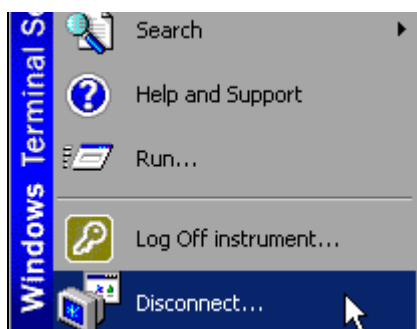
- Click the *Display* tab.
The options for configuring the R&S FMU screen display will appear.



- You can set the size of the R&S FMU window on the desktop of the controller by positioning the pointer in the *Remote desktop size* panel. The default setting is Full Screen.
- Do not change the *Colors* setting.
- Display the connection bar when in full screen mode:

If this option is enabled, a bar showing the network address of the R&S FMU will appear at the top edge of the screen. You can use this bar to reduce, minimize or close the window.

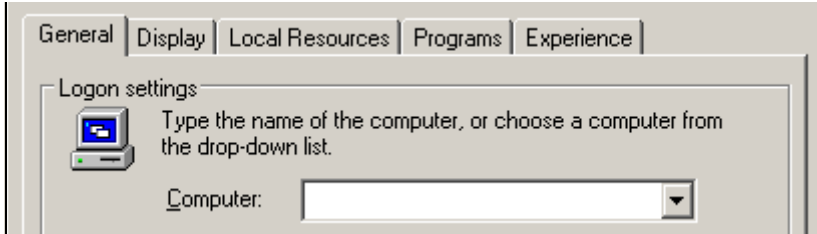
If this option is disabled, the only way you can return to the controller desktop from the R&S FMU screen in full screen mode is to select *Disconnect* from the Start menu:



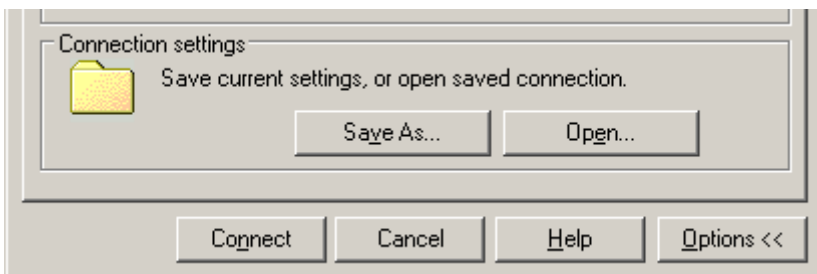
Connection Setup with the R&S FMU

After you configure the Remote Desktop Client, you need to set up the connection to the R&S FMU.

- Click the *General* tab. You can now enter the connection information.



- Enter the IP address of the R&S FMU in the *Computer* field.
- You can save the connection information for later use by clicking the *Save As...* button. You can use the *Open...* button to load an existing connection configuration.



- Press the *Connect* button.
The connection will be set up.
- If the entry *Disk Drives* is enabled on the *Local Resources* tab, a warning will appear indicating that the drives are enabled for access from the R&S FMU:



- Confirm the warning with *OK*.
Connection setup will be resumed.

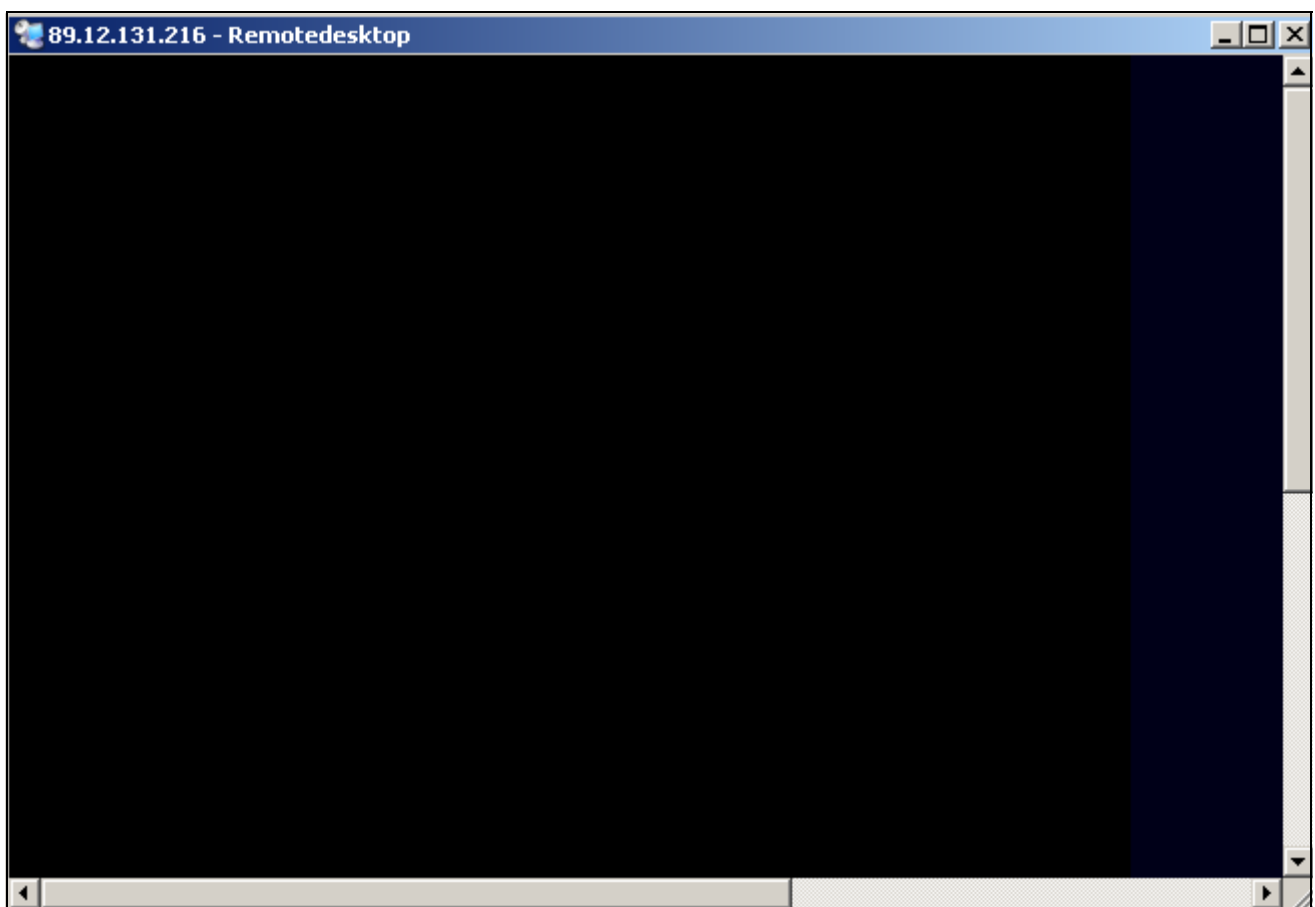
After a few moments, the screen of the R&S FMU will appear on the controller's screen with the prompt for you to log on. To enable remote control of the R&S FMU, do the following:



- Enter “instrument” as both the *user name* and the *password*. After a few moments, the R&S FMU screen will appear.

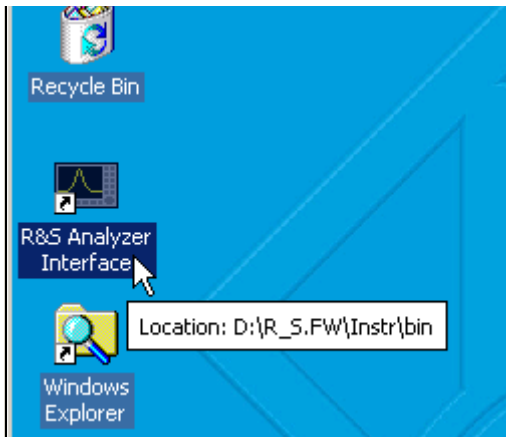
If the R&S FMU application appears on screen immediately after connection setup, shutdown and restart are not necessary.

If a dark screen appears or a dark square appears in the upper left-hand corner of the screen, you must restart the R&S FMU in order to see the modified screen resolution:



In this case, do the following:

- Press *ALT+F4*. The R&S FMU firmware will be shut down, which may take a few seconds.



- Double-click *R&S Analyzer Interface*.

The firmware will restart and then automatically open the *Soft Front Panel*, i.e. the user interface on which all front panel controls and the rotary knob are mapped to buttons.

After the connection is established the R&S FMU screen is displayed in the Remote Desktop application window.



You can operate all hardkeys, softkeys and hotkeys by using the mouse.

The rotary knob is simulated by means of the *KNOB LEFT*, *KNOB RIGHT* and *KNOB PRESS* buttons.

The Windows XP Start menu can be made available by expanding the Remote Desktop window to Full Size.

Interrupting and Restoring the Remote Desktop Connection with the R&S FMU

The connection to the R&S FMU can be interrupted at any time by closing the Remote Desktop window on the controller.

To restore the connection with the R&S FMU, merely follow the instructions provided in the section [“Connection Setup with the R&S FMU” on page 6.34](#). If the connection is interrupted and then restored, the R&S FMU remains in the same state.

During the connection with the controller, the login entry will appear on the R&S FMU screen. If the login procedure is completed successfully on the instrument, a message will appear on the controller display indicating that another user has assumed control of the instrument and that the connection was terminated as a result.

Deactivating the R&S FMU from the Controller

The R&S FMU can be deactivated via remote control. To do so, proceed as follows:

1. Click the R&S FMU soft front panel and close the application with *ALT+F4*.
2. Click the desktop and press *ALT+F4*.
A safety query will appear that warns you that the instrument cannot be reactivated via remote control and asks you whether you want to continue the shutdown process.
3. Respond to the safety query with YES.
The connection with the controller will then be terminated and the R&S FMU will be deactivated.

7 Brief Introduction to Remote Control

The instrument can be remote-controlled via the GPIB interface. For details on setting the GPIB interface see chapter 2, section [“Setting the GPIB Interface” on page 2.14](#).

Remote control via network (LAN interface) is provided also. For details on configuring the LAN interface see chapter 2, section [“Configuring the LAN Interface” on page 2.21](#).

The following programming examples are hierarchical in structure, i.e. the later examples are based on the preceding ones. This makes it possible to easily assemble a well-functioning program by using the modules of the program examples. More complex examples are provided in the Operating Manual, chapter 7.

The chapter is divided into the following sections:

- [“Basic Steps in Programming using the VISA Interface” on page 7.2](#)
- [“Detailed Programming Examples” on page 7.10](#)

Basic Steps in Programming using the VISA Interface

The following examples explain how to program the instrument and can be used as a basis for solving enhanced programming tasks.

Visual Basic was used as the programming language. However, the programs can be implemented in other languages as well.



Note

In programming languages as C, C++ or programmes as MATLAB, NI Interactive Control, a backslash starts an escape sequence (e.g. “\n” is used to start a new line). In these programming languages and programmes, two backslashes instead of one must be used in remote commands, e.g. in [“Storing Instrument Settings” on page 7.17](#):

instead of `MMEM:STOR:STAT 1, 'D:\USER\DATA\TEST1'`

use `MMEM:STOR:STAT 1, 'D:\\USER\\DATA\\TEST1'`

Linking the VISA Library for Visual Basic

Programming notes:

Outputting texts by using the "Print" function

The following programming examples are based on the assumption that all subroutines are created as part of a form (file extension .FRM). In this case, the following notation is permitted:

```
Print "Text"
```

However, if the subroutines are created as a module (file extension .BAS), the name of the form that contains the required print method must be placed in front of the print instruction. Thus, if a form is named "Main", the print instruction will be as follows:

```
Main.Print "Text".
```

Accessing the functions of the VISA32.DLL

To enable users to create Visual Basic control applications, the file dynamic link library VISA32.DLL has to be added to the project using the *References* command in the *Project* menu. In addition, the file VISA32.BAS is being added to the project. This file contains constants and definitions for error handling, time-out values, etc.

Declaring the DLL functions as procedures

All functions return a status variable that is defined as `Long`. Thus, all functions are declared in the file `VISA32.BAS` as follows:

```
Declare Function xxx Lib "visa32.dll" ( ... ) As Long
```

Creating a response buffer

Since the DLL returns zero-terminated strings in responses, a string of sufficient length must be created before the `viRead()` function is called, because Visual Basic inserts a length specification in front of the strings and this specification is not updated by the DLL. The following two means of creating the length specification for a string are provided:

```
Dim Rd as String * 100  
Dim Rd as String  
Rd = Space$(100)
```

Initialization and Default State

At the beginning of each program, the VISA resource manager has to be initialized. It opens a connection to the VISA driver itself, which controls the interaction with all instruments.

Creating Global Variables

In Visual Basic, global variables are stored in modules (data extension `.BAS`). Thus, at least one module (e.g. `GLOBALS.BAS`) must be created that contains the variables used by all subroutines, e.g. the variables for device handlers used by the VISA layer.

For all example programs shown below, the file must contain the following instructions:

```
Global analyzer As ViSession  
Global defaultRM As ViSession  
Const analyzerString = "GPIB0::20::INSTR"  
Const analyzerTimeout = 10000
```

The constant `analyzerString`, specifies the instrument. "GPIB0" specifies the control, whereas "20" specifies a certain instrument connected to the controller. Assuming the instrument was connected via a LAN cable and assigned the IP address 192.168.1.1, the corresponding string would read as:

```
Const analyzerString = "TCPIP::192.168.1.1::INSTR"
```

Initializing the Controller

This procedure first establishes a connection to the VISA layer and thereafter to the instrument specified by the analyzerString.

```

REM ----- Initializing the controller -----
Public SUB InitController()

Dim status As ViStatus

status = viOpenDefaultRM(defaultRM)
status = viOpen(defaultRM, analyzerString, VI_NULL, VI_NULL, analyzer)
        'Opens connection to Default Resource Manager and returns a handle to it

END SUB
REM *****

```

Initializing the Instrument

The instrument is set to its default settings and the status register is cleared.

```

REM ----- Initializing the instrument -----
Public SUB InitDevice()

Dim status As ViStatus
Dim retCnt As Long

status = viWrite(analyzer, "*CLS", 4, retCnt)           'Reset status register
status = viWrite(analyzer, "*RST", 4, retCnt)           'Reset instrument

END SUB
REM*****

```

Switching the Screen Display On and Off

In the default setting, all remote control commands are carried out with the screen display switched off in order to attain optimum measurement speed. During the development phase of remote control programs, however, the screen display is required in order to visually check both the programming of the settings and the measurement results.

The following examples show functions that switch the screen display on or off during remote control.


```

REM ----- Switching on the screen display -----
Public SUB DisplayOn()

Dim status As ViStatus
Dim retCnt As Long

status = viWrite(analyzer, "SYST:DISP:UPD ON", 16, retCnt)
                'Switch on screen display

END SUB
REM*****

REM ----- Switching off the screen display -----
Public SUB DisplayOff()

Dim status As ViStatus
Dim retCnt As Long

status = viWrite(analyzer, "SYST:DISP:UPD OFF", 17, retCnt)
                'Switch off screen display

END SUB
REM*****

```

Configuring the Power Save Function for the Display

During remote operation, it is often unnecessary to display the measurement results on screen. Although the `SYSTem:DISPlay:UPDate OFF` command switches off the display of the measurement results, thus significantly improving speed during remote control, the display itself and the background lighting in particular remain switched on.

If you also want to switch off the display itself, you must use the Power Save function by setting the response time in minutes prior to activation.



Note

The display will be immediately reactivated if you press a key on the instrument's front panel.

```

REM ----- Switching on Power Save function -----
Public SUB PowerSave()

Dim status As ViStatus
Dim retCnt As Long

status = viWrite(analyzer, "DISP:PSAV:HOLD 1", 16, retCnt)
                        'Set response time to 1 minute
status = viWrite(analyzer, "DISP:PSAV ON", 12, retCnt)
                        'Switch on Power Save function

END SUB
REM*****

```

Sending Simple Instrument Setting Commands

This example shows how the center frequency, span and reference level of the instrument are set.

```

REM ----- Instrument setting commands -----
PUBLIC SUB SimpleSettings()

Dim status As ViStatus
Dim retCnt As Long

status = viWrite(analyzer, "FREQUENCY:CENTER 10MHZ", 22, retCnt)
                        'Center frequency 10 MHz
status = viWrite(analyzer, "FREQUENCY:SPAN 1MHZ", 19, retCnt)
                        'Set span to 1 MHz
status = viWrite(analyzer, "DISPLAY:TRACE:Y:RLEVEL 0.1V", 27, retCnt)
                        'Set reference level to 0.1 Volt peak (-10 dBm)

END SUB
REM *****

```

Reading Out Instrument Settings

The settings made above can now be read out. To do so, the abbreviated commands are used.

```

REM ----- Reading out instrument settings -----
PUBLIC SUB ReadSettings()

Dim status As ViStatus
Dim retCnt As Long

```

```

CFfrequenz$ = Space$(20)           'Provide text variable (20 characters)
status = viWrite(analyzer, "FREQ:CENT?", 10, retCnt)
                                   'Request center frequency
status = viRead(analyzer, CFfrequenz$, 20, retCnt)
                                   'Read in value
CFspan$ = Space$(20)               'Provide text variable (20 characters)
status = viWrite(analyzer, "FREQ:SPAN?", 10, retCnt)
                                   'Request span
status = viRead(analyzer, CFspan$, 20, retCnt)
                                   'Read in value
RLpegel$ = Space$(20)              'Provide text variable (20 characters)
status = viWrite(analyzer, "DISP:TRAC:Y:RLEV?", 17, retCnt)
                                   'Request ref level setting
status = viRead(analyzer, RLpegel$, 20, retCnt)
                                   'Read in value

```

```

REM ----- Displaying values on the screen -----
Print "Center frequency: "; CFfrequenz$,
Print "Span:           "; CFspan$,
Print "Reference level: "; RLpegel$,

```

END SUB

REM*****

Marker Positioning and Readout

```

REM ----- Example of marker function -----
PUBLIC SUB ReadMarker()

```

```

status = viWrite(analyzer, "CALC:MARKER ON;MARKER:MAX", 25, retCnt)
                                   'Activate marker 1 and search for peak
MKmark$ = Space$(30)               'Provide text variable (30 characters)
status = viWrite(analyzer, "CALC:MARK:X?;Y?", 15, retCnt)
status = viRead(analyzer, MKmark$, 30, retCnt)
                                   'Query frequency and level and read in value

```

```

REM ----- Displaying values on the screen -----
Print "Marker frequency/level "; MKmark$,

```

END SUB

REM*****

Command Synchronization

The synchronization methods used in the following example are described in the Operating Manual, chapter 5, section "Command Sequence and Command Synchronization".



Note

Service requests are only supported by GPIB and VXI instruments.

```

REM ----- Commands for command synchronization -----
PUBLIC SUB SweepSync()

Dim status As ViStatus
Dim retCnt As Long
Dim etype As ViEventType
Dim eevent As ViEvent
Dim stat As Integer

Rem The command INITiate[:IMMEDIATE] starts a single sweep if the
Rem command INIT:CONT OFF has already been sent. The next command
Rem must not be carried out until a full sweep has been completed.

status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
REM ----- First method: Using *WAI -----
status = viWrite(analyzer, "ABOR;INIT:IMM;*WAI", 18, retCnt)
REM ----- Second method: Using *OPC? -----
OpcOk$ = Space$(2)
status = viWrite(analyzer, "ABOR;INIT:IMM; *OPC?", 20, retCnt)
                'Provide space for *OPC? response
REM In this case, the controller can use other instruments:
status = viRead(analyzer, OpcOk$, 2, retCnt)
                'Wait for "1" from *OPC?
REM ----- Third method: Using *OPC -----
Rem In order for the Service Request function to be used with a GPIB
Rem driver from National Instruments, the setting
Rem "Disable Auto Serial Poll" must be set to "yes" with IBCONF!

status = viWrite(analyzer, "*SRE 32", 7, retCnt)
                'Enable Service Request for ESR
status = viWrite(analyzer, "*ESE 1", 6, retCnt)
                'Set event enable bit for operation complete bit
status = viEnableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE, VI_NULL)
                'Enable SRQ event
status = viWrite(analyzer, "ABOR;INIT:IMM;*OPC", 18, retCnt)
                'Start sweep with synchronization to OPC
status = viWaitOnEvent(analyzer, VI_EVENT_SERVICE_REQ, 10000, etype, eevent)
                'Wait for Service Request
status = viReadSTB(analyzer, stat)

```

```

status = viClose(eevent)
                                'Close event handler
status = viDisableEvent(analyzer, VI_EVENT_SERVICE_REQ, VI_QUEUE)
                                'Disable SRQ Event

REM Resume main program here.
END SUB
REM *****

```

Reading Output Buffers

```

REM ----- Subroutine for the individual STB bits -----
Public SUB Outputqueue()          'Reading the output queue

Dim status As ViStatus
Dim retCnt As Long

result$ = Space$(100)            'Create space for response
status = viRead(analyzer, result$, 100, retCnt)
Print "Contents of Output Queue : "; result$

END SUB
REM *****

```

Reading Error Messages

```

REM ----- Subroutine for evaluating the error queue -----
Public SUB ErrorQueueHandler()

Dim status As ViStatus
Dim retCnt As Long

sError$ = Space$(100)            'Subroutine for evaluating the error queue
status = viWrite(analyzer, "SYSTEM:ERROR?", 13, retCnt)
status = viRead(analyzer, sError$, 100, retCnt)
Print "Error Description : "; sError$

END SUB
REM *****

```

Detailed Programming Examples

Default Settings of the R&S FMU

The following settings provide typical examples of how to change the default settings of the R&S FMU.

Note that only some of the settings are necessary depending on the application example. In many cases, it is not necessary to set the resolution bandwidth since this parameter is automatically calculated in the default setting when the span is changed. The level detectors are linked to the selected trace mode in the default setting.

The settings automatically calculated in the default setting are indicated with an asterisk (*) in the following program example.

Setting the IEC Bus Status Registers

```

REM *****
Public Sub SetupStatusReg()

Dim status As ViStatus
Dim retCnt As Long
REM ----- IEEE 488.2 status register -----
status = viWrite(analyzer, "*CLS", 4, retCnt)
                'Reset status registers
status = viWrite(analyzer, "*SRE 168", 8, retCnt)
                'Enable Service Request for STAT:OPER-,
                'STAT:QUES- and ESR-Register
status = viWrite(analyzer, "*ESE 61", 7, retCnt)
                'Set event enable bit for:
                'operation complete
                'command-, execution-, device
                'dependent- and query error

REM ----- SCPI status register -----
status = viWrite(analyzer, "STAT:OPER:ENAB 0", 16, retCnt)
                'Disable OPERation Status Register
status = viWrite(analyzer, "STAT:QUES:ENAB 0", 16, retCnt)
                'Disable QUEStionable Status Register

End Sub
REM *****

```

Default Settings for Measurements

```
REM *****
```

```
Public Sub SetupInstrument()
```

```
Dim status As ViStatus
```

```
Dim retCnt As Long
```

```
REM ----- Default setting of the R&S FMU -----
```

```
Call SetupStatusReg 'Configure status registers
```

```
status = viWrite(analyzer, "*RST", 4, retCnt)
```

```
'Reset instrument
```

```
status = viWrite(analyzer, "SYST:DISP:UPD ON", 16, retCnt)
```

```
'ON: screen display on, OFF: off (improved performance)
```

```
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
```

```
'Single sweep mode
```

```
REM ----- Input path settings -----
```

```
status = viWrite(analyzer, "INP:IQ:TYPE I", 13, retCnt) 'Signal path I only
```

```
status = viWrite(analyzer, "INP:IQ:BAL OFF", 14, retCnt) 'Unbalanced
```

```
status = viWrite(analyzer, "INP:IQ:IMP LOW", 14, retCnt) 'Impedance 50
```

```
REM ----- Frequency setting -----
```

```
status = viWrite(analyzer, "FREQUENCY:CENTER 10MHz", 22, retCnt)
```

```
'Center frequency
```

```
status = viWrite(analyzer, "FREQ:SPAN 1 MHz", 15, retCnt)
```

```
'Span
```

```
REM ----- Level setting -----
```

```
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:RLEV 0.1V", 26, retCnt)
```

```
'Reference level
```

```
REM ----- Level scaling -----
```

```
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:SPAC LOG", 25, retCnt)
```

```
'Log level axis
```

```
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:SCAL 100dB", 27, retCnt)
```

```
'Level range
```

```
status = viWrite(analyzer, "CALC:UNIT:POW DBM", 17, retCnt)
```

```
'y meas. unit
```

```
REM ----- Trace and detector setting -----
```

```
status = viWrite(analyzer, "DISP:WIND:TRAC1:MODE AVER", 25, retCnt)
```

```
'Trace1 average
```

```
status = viWrite(analyzer, "AVER:TYPE LIN", 13, retCnt)
```

```
'"LIN" for linear
```

```
status = viWrite(analyzer, "SWE:COUN 10", 11, retCnt)
```

```
'Sweep count
```

```
status = viWrite(analyzer, "DISP:WIND:TRAC2:STAT OFF", 24, retCnt)
```

```
'Trace2 blank
```

```
status = viWrite(analyzer, "DISP:WIND:TRAC3:STAT OFF", 24, retCnt)
```

```
'Trace3 blank
```

```
status = viWrite(analyzer, "CALC:MATH:STAT OFF", 18, retCnt)
```

```
'Trace difference off
```

```
status = viWrite(analyzer, "DETECTOR1 RMS", 13, retCnt)
```

```
'Detector Trace1 (*)
```

```

status = viWrite(analyzer, "DET2:AUTO ON", 12, retCnt)
                'Detector Trace2    (*)
status = viWrite(analyzer, "DET3:AUTO ON", 12, retCnt)
                'Detector Trace3    (*)
REM ----- Bandwidths-----
status = viWrite(analyzer, "BAND:RES 20KHz", 14, retCnt) 'Resolution bandwidth (*)

END SUB
REM *****

```

Using Markers and Delta Markers

Marker Search Functions, Restricting the Search Range

The following example is based on an AM-modulated signal at 10 MHz that has the following characteristics:

- Carrier signal level: -30 dBm
- AF frequency: 100 kHz
- Modulation depth: 50%

Marker 1 and then delta marker 2 are set to the largest maximum points on the trace. The frequency and level are then read. In the following measurements, the instrument's default setting can be used for measurements (SetupInstrument).

```

REM *****
Public Sub MarkerSearch()

Dim status As ViStatus
Dim retCnt As Long

result$ = Space$(100)
Call SetupInstrument          'Default Setting
REM ----- Peak search without search range limits-----
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)
                'Switch to single sweep
status = viWrite(analyzer, "CALC:MARK:PEXC 6DB", 18, retCnt)
                'Define peak excursion
status = viWrite(analyzer, "CALC:MARK:STAT ON", 17, retCnt)
                'Enable marker 1
status = viWrite(analyzer, "CALC:MARK:TRAC 1", 16, retCnt)
                'Set marker 1 to trace 1
status = viWrite(analyzer, "INIT:*WAI", 9, retCnt)
                'Perform sweep with sync
status = viWrite(analyzer, "CALC:MARK:MAX;X?;Y?", 19, retCnt)
                'Marker to peak; read frequency and level
status = viRead(analyzer, result$, 100, retCnt)
Print "Marker 1: "; result$

```



```

status = viWrite(analyzer, "CALC:DELT2:STAT ON;MAX;MAX:LEFT", 31, retCnt)
                'Activate delta marker 2, set to peak and then
                'to next peak left
status = viWrite(analyzer, "CALC:DELT2:X?;Y?", 16, retCnt)
                'Read delta marker 2 frequency and level
status = viRead(analyzer, result$, 100, retCnt)
Print "Delta 2: "; result$
REM ----- Peak search with search range limit in x direction -----
status = viWrite(analyzer, "CALC:MARK:X:SLIM:STAT ON;LEFT 0Hz;RIGHT 10.05MHz", 48,
retCnt)
                'Activate search limit and set at right below AF
status = viWrite(analyzer, "CALC:DELT3:STAT ON;MAX;MAX:RIGHT", 32, retCnt)
                'Activate delta marker 3, 'set to peak and then
                'to next peak right
status = viWrite(analyzer, "CALC:DELT3:X:REL?;:CALC:DELT3:Y?", 32, retCnt)
                'Read delta marker 3 frequency and level;
                'both must have a value of 0
status = viRead(analyzer, result$, 100, retCnt)
Print "Delta 3: "; result$
REM ----- Peak search with search range limit in y direction -----
status = viWrite(analyzer, "CALC:THR:STAT ON", 16, retCnt)
status = viWrite(analyzer, "CALC:THR -35DBM", 15, retCnt)
                'Activate threshold and set it above the AF
status = viWrite(analyzer, "CALC:DELT3:STAT ON;MAX;MAX:NEXT", 31, retCnt)
                'Activate delta marker 3, set to peak and then
                'to next peak => is not found
status = viWrite(analyzer, "CALC:DELT3:X:REL?;:CALC:DELT3:Y?", 32, retCnt)
                'Query and read delta marker 3 frequency and
                'level; both must have a value of 0
status = viRead(analyzer, result$, 100, retCnt)
Print "Delta 3: "; result$

END SUB
REM *****

```

Measuring Noise and Phase Noise

When phase noise is measured, the noise power related to a bandwidth of 1 Hz is set in relation to the power of an adjacent carrier signal. A commonly used offset between the measured frequency and the carrier frequency is 10 kHz.

When noise is measured, the measured absolute level is related to a bandwidth of 1 Hz.

The following example is based on a signal at 10 MHz with a level of -20 dBm. Two markers are used to determine both the noise and the phase noise at a 10 kHz offset from the carrier signal.

```

REM *****
Public Sub Noise()

Dim status As ViStatus
Dim retCnt As Long

result$ = Space$(100)
REM ----- Default setting of the R&S FMU -----
Call SetupStatusReg 'Configure status register
status = viWrite(analyzer, "*RST", 4, retCnt) 'Reset instrument
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)'Single sweep mode
REM ----- Input path settings -----
status = viWrite(analyzer, "INP:IQ:TYPE I", 13, retCnt) 'Signal path I only
status = viWrite(analyzer, "INP:IQ:BAL OFF", 14, retCnt) 'Unbalanced
status = viWrite(analyzer, "INP:IQ:IMP LOW", 14, retCnt) 'Impedance 50
REM ----- Setting the frequency -----
status = viWrite(analyzer, "FREQUENCY:CENTER 10MHz", 22, retCnt) 'Center frequency
status = viWrite(analyzer, "FREQ:SPAN 100 kHz", 17, retCnt) 'Span
REM ----- Setting the level -----
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:RLEV -20dBm", 28, retCnt)
'Reference level
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt) 'Perform sweep with sync
REM ----- Setting the reference point -----
status = viWrite(analyzer, "CALC:MARK:PEXC 6DB", 18, retCnt)
'Define peak excursion
status = viWrite(analyzer, "CALC:MARK:STAT ON", 17, retCnt)
'Activate marker 1
status = viWrite(analyzer, "CALC:MARK:TRAC 1", 16, retCnt)
'Set marker 1 to trace 1
status = viWrite(analyzer, "CALC:MARK:MAX", 13, retCnt)
'Set marker 1 to 10 MHz
status = viWrite(analyzer, "CALC:DELT:FUNC:PNO ON", 21, retCnt)
'Define reference point for phase noise
REM ----- Measuring the phase noise -----
status = viWrite(analyzer, "CALC:DELT:X 10kHz", 17, retCnt)
'Position delta marker
status = viWrite(analyzer, "CALC:DELT:FUNC:PNO:RES?", 23, retCnt)
'Query phase noise result
status = viRead(analyzer, result$, 100, retCnt)
Print "Phase Noise [dBc/Hz]: "; result$
REM ----- Measuring the noise -----
status = viWrite(analyzer, "CALC:MARK:X 9.99MHz", 19, retCnt)
'Position marker 1
status = viWrite(analyzer, "CALC:MARK:FUNC:NOIS:RES?", 24, retCnt)
'Query and output result
status = viRead(analyzer, result$, 100, retCnt)
Print "Noise [dBm/Hz]: "; result$

END SUB
REM *****

```

Reading Out Trace Data

In the following example, the trace data obtained with the default setting is read from the instrument and displayed in a list on screen. Readout occurs first in binary format and then in ASCII format, once with the span > 0 and once with the span = 0.

In binary format, the header of the message with the length specification is evaluated and used to calculate the x axis values.

In ASCII format, merely the list of level values is output.

Binary data is read out in three steps:

1. The number of digits in the length specification is read out.
2. The length specification itself is read out.
3. The trace data itself is read out.

The procedure is required in the case of programming languages that only support structures with data types of the same type (arrays) (such as with Visual Basic), because the data types of the header and data sections are different in binary data.

Note that the function viRead32 is not declared in VISA32.BAS and therefore needs to be defined separately:

```
Declare Function viRead32 Lib "Visa32" Alias "viRead" (ByVal vi As Long, Values As Any, ByVal count As Long, retCount As Long) As Long
```



Note

The arrays for the measured data are dimensioned in such a way that they provide sufficient space for trace data of the R&S FMU (625 measurement points).

```
REM *****  
Public Sub ReadTrace()
```

```
Dim status As ViStatus  
Dim retCnt As Long
```

```
REM ----- Creating variables -----  
Dim traceData(1250) As Single      'Buffer for floating point binary data  
Dim digits As Byte                 'Number of characters in length specification  
Dim traceBytes As Integer          'Len. of trace data in bytes  
Dim traceValues As Integer         'No. of meas. values in buff.  
asciiResult$ = Space$(25000)      'Buffer for ASCII trace data  
result$ = Space$(100)              'Buffer for simple results  
startFreq$ = Space$(100)          'Buffer for start frequency  
span$ = Space$(100)               'Buffer for span
```

```

REM ----- Default setting of the R&S FMU -----
Call SetupInstrument                                'Default setting
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt) 'Switch to single sweep
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)    'Perform sweep with sync
REM ----- Defining the frequency range for output -----
status = viWrite(analyzer, "FREQ:START?", 11, retCnt) 'Read start frequency
status = viRead(analyzer, startFreq$, 100, retCnt)
startFreq = Val(startFreq$)
status = viWrite(analyzer, "FREQ:SPAN?", 10, retCnt)  'Read span
status = viRead(analyzer, span$, 100, retCnt)
span = Val(span$)
REM ----- Reading out in binary format -----
status = viWrite(analyzer, "FORMAT REAL,32", 14, retCnt)
                                'Set binary format
status = viWrite(analyzer, "TRAC1? TRACE1", 13, retCnt)
                                'Read trace 1
status = viRead(analyzer, result$, 2, retCnt)
                                'Read and store length spec. for number of
digits = Val(Mid$(result$, 2, 1)) 'characters
result$ = Space$(100)           'Reinitialize buffer
status = viRead(analyzer, result$, digits, retCnt)
                                'Read and store length specification
traceBytes = Val(Left$(result$, digits))
status = viRead32(analyzer, traceData(0), traceBytes, retCnt)
                                'Read trace data into buffer
status = viRead(analyzer, result$, 1, retCnt)
                                'Read in delimiter <NL>
REM ----- Outputting binary data as frequency/level pairs -----
traceValues = traceBytes / 4      'Single precision = 4 bytes
stepsize = span / traceValues    'Calculate frequency step size
For i = 0 To traceValues - 1
Print "Value["; i; "] = "; startFreq + stepsize * i; ", "; traceData(i)
Next i
REM ----- Default setting of the time domain -----
status = viWrite(analyzer, "FREQ:SPAN 0Hz", 13, retCnt) 'Switch to time domain
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)    'Perform sweep with sync
REM ----- Reading out in ASCII format -----
status = viWrite(analyzer, "FORMAT ASCII", 12, retCnt) 'Set ASCII format
status = viWrite(analyzer, "TRAC1? TRACE1", 13, retCnt) 'Read and output
status = viRead(analyzer, asciiResult$, 25000, retCnt)
Print "Contents of Tracel: ", asciiResult$ 'trace 1

END SUB
REM *****

```

Storing and Loading Instrument Settings

Storing Instrument Settings

In the following example, the settings/measured data to be stored are initially defined, in which case only the hardware settings are stored. However, the selection commands for the other settings are specified with the state "OFF" for the sake of completeness.

```

REM *****
Public Sub StoreSettings()

Dim status As ViStatus
Dim retCnt As Long

'This subroutine selects the settings to be stored and creates the
'data record "TEST1" in the directory D:\USER\DATA. It uses the default
'setting and resets the instrument after the setting is stored.
REM ----- Default settings of the R&S FMU -----
Call SetupInstrument
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt)   'Change to single sweep
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)       'Perform sweep with sync
REM ----- Selection of settings to be stored -----
status = viWrite(analyzer, "MMEM:SEL:HWS ON", 15, retCnt)
                    'Store hardware settings
status = viWrite(analyzer, "MMEM:SEL:TRAC OFF", 17, retCnt)
                    'Do not store any traces
status = viWrite(analyzer, "MMEM:SEL:LIN:ALL OFF", 20, retCnt)
                    'Store only the activated limit lines
REM ----- Entering comments -----
status = viWrite(analyzer, "MMEM:COMM 'Test Setup'", 22, retCnt)
REM ----- Storing on the instrument -----
status = viWrite(analyzer, "MMEM:STOR:STAT 1,'D:\USER\DATA\TEST1'", 37, retCnt)
REM ----- Resetting the instrument -----
status = viWrite(analyzer, "*RST", 4, retCnt)

END SUB
REM *****

```

Loading Instrument Settings

In the following example, the *TEST1* data record stored under *D:\USER\DATA* is reloaded into the instrument:

```

REM *****
Public Sub LoadSettings()

Dim status As ViStatus
Dim retCnt As Long

'This subroutine loads the TEST1 data record in the directory D:\USER\DATA.
REM ----- Default setting of the status register -----
Call SetupStatusReg           'Configure status register
'----- Loading the data record -----
status = viWrite(analyzer, "MMEM:LOAD:STAT 1,'D:\USER\DATA\TEST1'", 37, retCnt)
REM ----- Performing measurement using loaded data record -----
status = viWrite(analyzer, "DISP:TRAC1:MODE WRITE", 21, retCnt)
                                'Set trace to Clr/Write
status = viWrite(analyzer, "INIT;*WAI", 9, retCnt)
                                'Start sweep

END SUB
REM *****

```

Setting the Data Record for Startup Recall

In the following example, the first step is to change the R&S FMU to the default state. In the next step, the *TEST1* data record stored under *D:\USER\DATA* is selected for the STARTUP RECALL function, i.e. the data record is then set after each *RST, PRESET and each time the instrument is started. For demonstration purposes, the command *RST is carried out again.

```

REM *****
Public Sub StartupRecallSettings()

Dim status As ViStatus
Dim retCnt As Long

REM ----- Resetting the R&S FMU -----
status = viWrite(analyzer, "*RST", 4, retCnt)
REM ----- Default setting of the status register -----
Call SetupStatusReg           'Configure status register
'----- Selecting the startup recall data record -----
status = viWrite(analyzer, "MMEM:LOAD:AUTO 1,'D:\USER\DATA\TEST1'", 37, retCnt)
REM ----- Activating the startup recall data record -----
status = viWrite(analyzer, "*RST", 4, retCnt)

END SUB
REM *****

```

Configuring and Starting a Printout

The following example shows how to configure the output format and output device for printing out a measurement screen.

The procedure is as follows:

1. Set the measurement you want for the printout.
2. Check which output devices are available on the instrument.
3. Select an output device.
4. Select the output interface.
5. Configure the output format.
6. Start the printout with synchronization to the end.

It is assumed that the desired setting is a signal at 10 MHz with a power of –20 dBm. It is also assumed that the sixth printer out of the available printers that are listed is the one you want. The printout is first output to the selected printer and then to a file.

```

REM *****
Public Sub HCopy ()

Dim status As ViStatus
Dim retCnt As Long

Dim Devices(100) As String      'Create buffer for
                                'printer name

For i = 0 To 49
    Devices$(i) = Space$(50)    'Preallocate buffer for printer name
Next i

REM ----- Default setting of the R&S FMU -----
Call SetupStatusReg            'Configure status register
status = viWrite(analyzer, "*RST", 4, retCnt)      'Reset instrument
status = viWrite(analyzer, "INIT:CONT OFF", 13, retCnt) 'Single sweep mode
status = viWrite(analyzer, "SYST:DISP:UPD ON", 16, retCnt)
                                                'Screen display on

REM ----- Measurement settings -----
status = viWrite(analyzer, "FREQ:CENT 10MHz;SPAN 1MHz", 25, retCnt)
                                                'Frequency setting
status = viWrite(analyzer, "DISP:WIND:TRAC:Y:RLEV -10dBm", 28, retCnt)
                                                'Reference Level
status = viWrite(analyzer, "INIT;*WAI", 10, retCnt) 'Perform measurement

REM ----- Querying the available output devices -----
status = viWrite(analyzer, "SYST:COMM:PRIN:ENUM:FIRSt?", 26, retCnt)
                                                'Read out and display first output device
status = viRead(analyzer, Devices$(0), 100, retCnt)
Print "Printer 0: " + Devices$(0)

```

```

For i = 1 To 99
    status = viWrite(analyzer, "SYST:COMM:PRIN:ENUM:NEXT?", 24, retCnt)
        'Read out next printer name
    status = viRead(analyzer, Devices$(i), 100, retCnt)
    If Left$(Devices$(i), 2) = "" Then GoTo SelectDevice
        'Stop at end of list
    Print "Printer" + Str$(i) + ": "; Devices$(i)
        'Display printer name
Next i
SelectDevice:
REM - Selection of output device, printer language and output interface ----
status = viWrite(analyzer, "SYST:COMM:PRIN:SEL " + Devices(6), 19 + Len(Devices(6)),
retCnt)
    'Printer selection #6
status = viWrite(analyzer, "HCOP:DEST 'SYST:COMM:PRIN'", 26, retCnt)
    'Configuration: "Printout to printer interface"
status = viWrite(analyzer, "HCOP:DEV:LANG GDI", 17, retCnt)
    'Printers require printer language 'GDI'
REM -- Selection of orientation (portrait/landscape) and color/BW -----
status = viWrite(analyzer, "HCOP:PAGE:ORI PORTRait", 22, retCnt)
    'Portrait orientation
status = viWrite(analyzer, "HCOP:DEV:COL OFF", 16, retCnt)
    'Black-and-white printout
REM -- Configuring and starting the printout -----
status = viWrite(analyzer, "HCOP:ITEM:ALL", 13, retCnt)
    'All screen contents
'status = viWrite(analyzer, "HCOP:ITEM:WIND1:TRACE:STAT ON", 29, retCnt)
'status = viWrite(analyzer, "HCOP:ITEM:WIND2:TRACE:STAT ON", 29, retCnt)
    'Alternative: only traces in screen A/B
status = viWrite(analyzer, "*CLS", 4, retCnt)
    'Reset status administration
status = viWrite(analyzer, "HCOP:IMMediate;*OPC?", 19, retCnt)
    'Start printout
status = viRead(analyzer, result$, 100, retCnt)
REM - Printout in WMF format (BMP format) to file -----
status = viWrite(analyzer, "HCOP:DEST 'MMEM'", 16, retCnt)
    'Configuration: "Printout to file"
status = viWrite(analyzer, "HCOP:DEV:LANG WMF", 17, retCnt)
    'WMF file format
'status = viWrite(analyzer, "HCOP:DEV:LANG BMP", 17, retCnt)
    'BMP file format
status = viWrite(analyzer, "MMEM:NAME 'D:\USER\DATA\PRINT1.WMF'", 35, retCnt)
    'Define file name
status = viWrite(analyzer, "*CLS", 4, retCnt)
    'Reset Status administration
status = viWrite(analyzer, "HCOP:IMMediate;*OPC?", 19, retCnt)
    'Start printout
status = viRead(analyzer, result$, 100, retCnt)

END SUB
REM *****

```


Appendix

Appendix A: Printer Interface

Installing Non-Plug&Play Printers

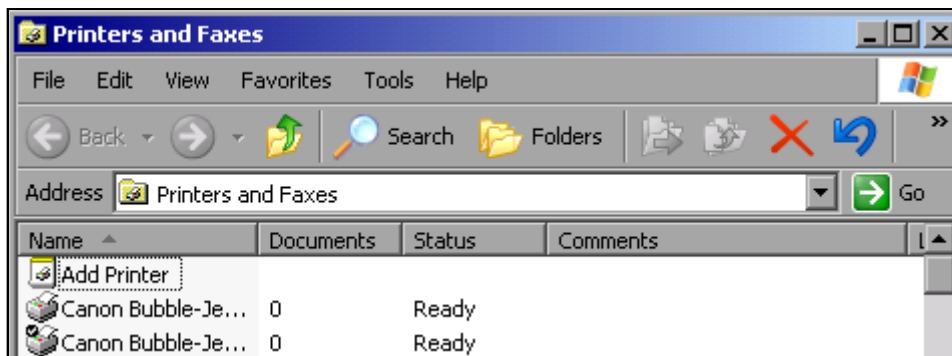


Note

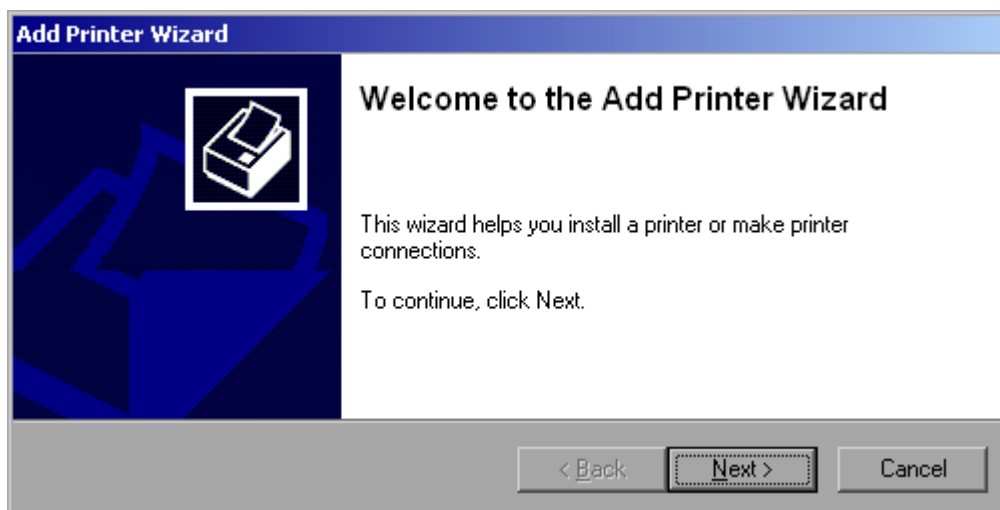
The following dialog boxes can be operated either from the front panel or via a mouse and keyboard (see sections “[Connecting a Mouse](#)” and “[Connecting an External Keyboard](#)” on page 2.7).

A new printer is installed using *HCOPY - NEXT - INSTALL PRINTER*.

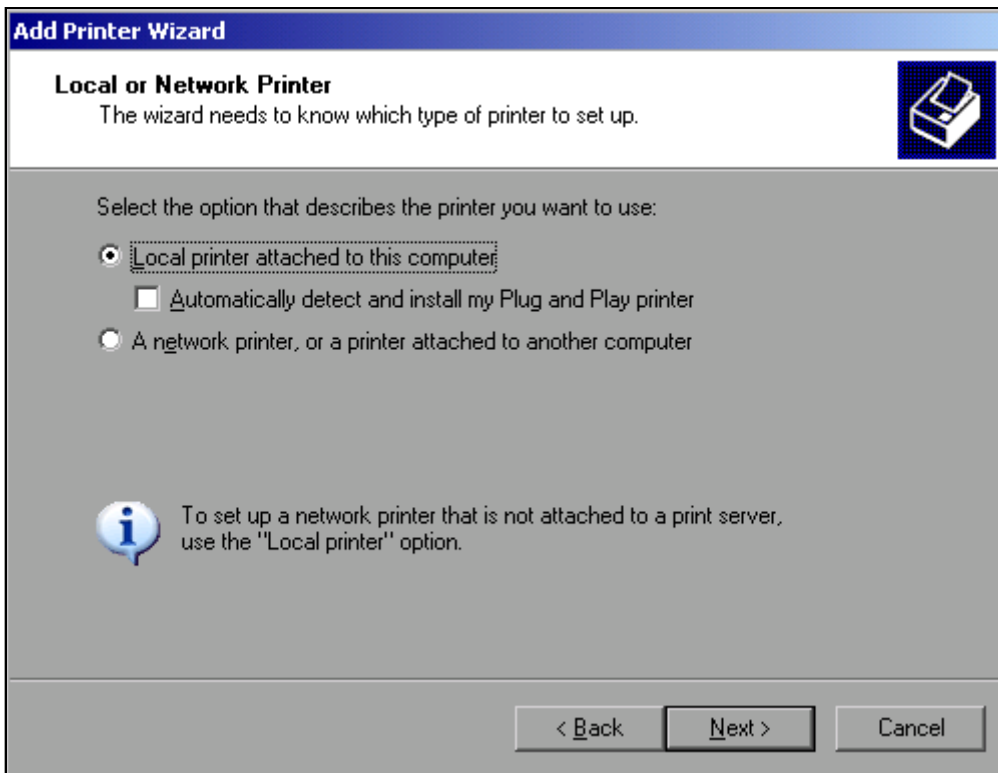
Local Printer



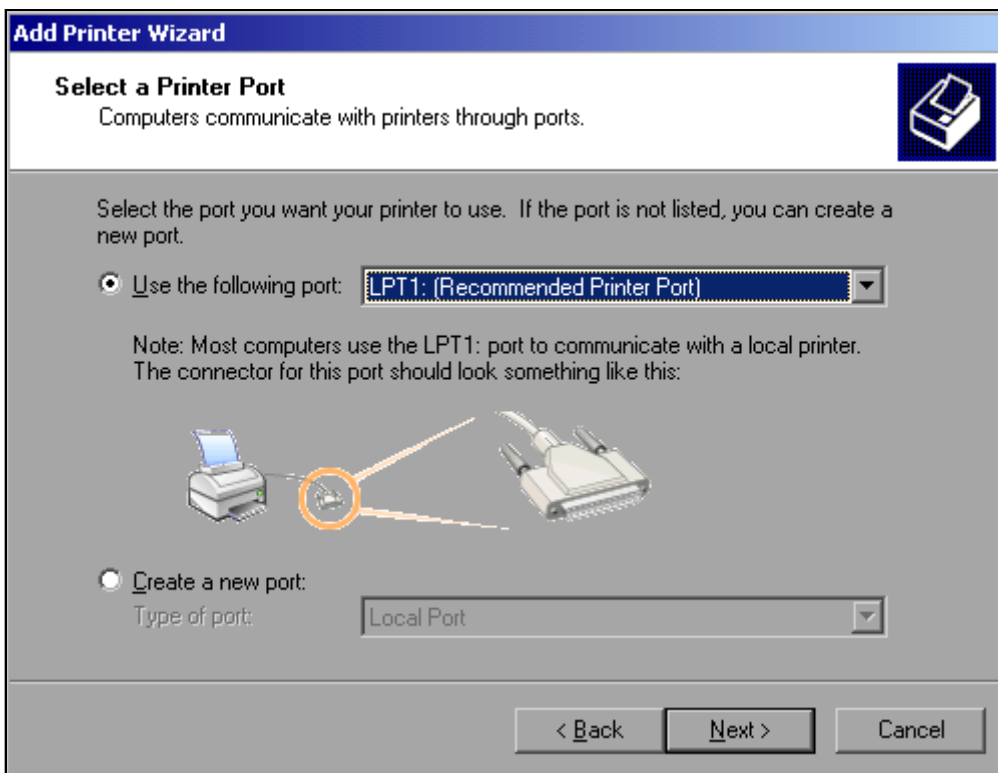
- Using the rotary knob, select *Add Printer* from the list.
- Mark the selected item with the right arrow key, and press *ENTER* or the rotary knob to confirm the selection.
The *Add Printer Wizard* will appear.



- Using the rotary knob, select *NEXT* and confirm by pressing the rotary knob.

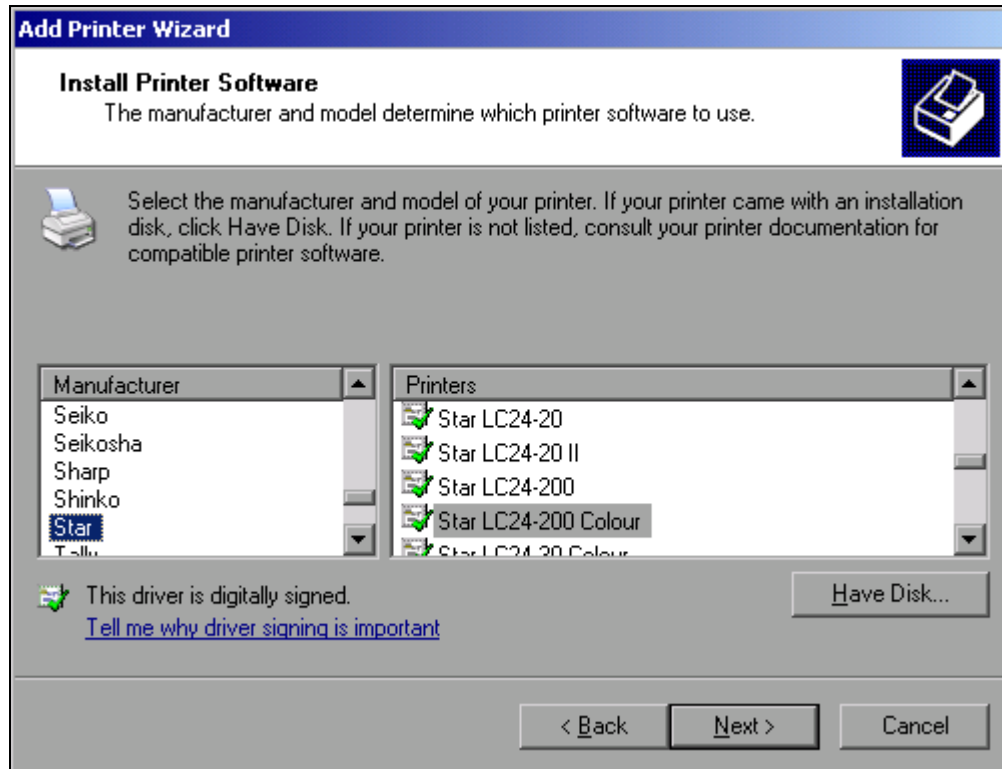


- To install a local printer, select *Local printer attached to this computer* with the rotary knob, confirm by pressing the rotary knob and continue to the next step.
- To install a network printer, select *A network printer or a printer attached to another computer*, confirm by pressing the rotary knob and continue to the next step.



In the following example, a local printer of type Star LC24 is installed.

- To select a USB connection, open the list of available ports by pressing the rotary knob. Using the arrow keys or rotary knob, select a printer port and confirm by pressing the rotary knob.
- To select an LPT connection, you do need not to open the selection list.
- Using the rotary knob, move the focus to the *Next* button and confirm by pressing the rotary knob.
The *Install Printer Software* dialog panel will open.

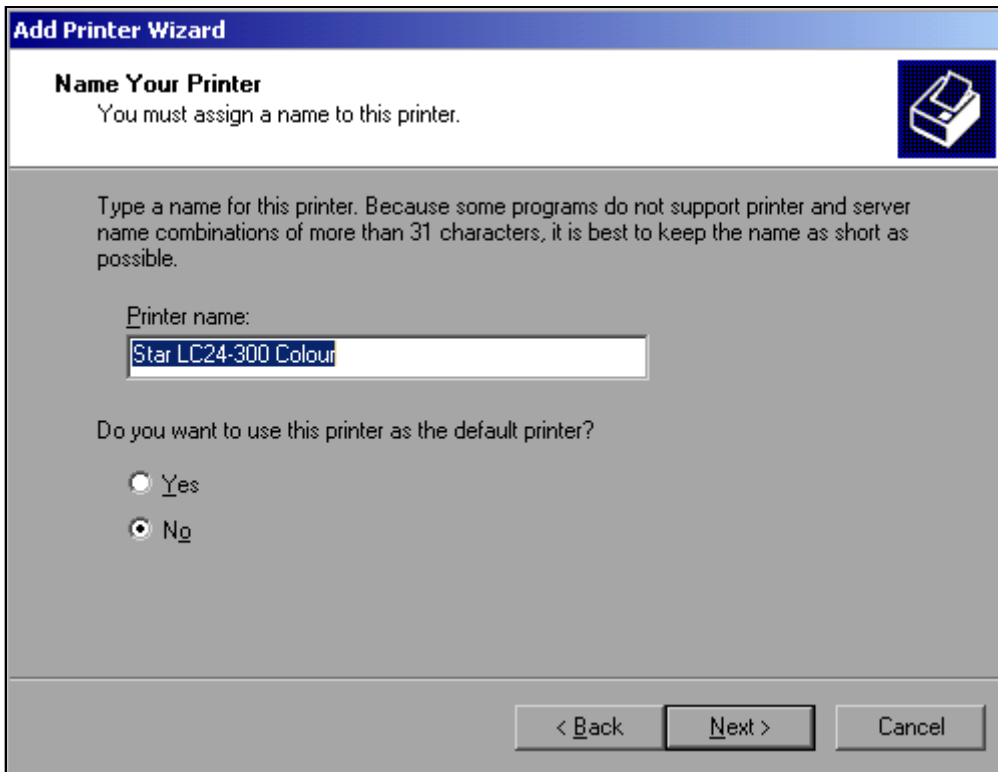


- Using the arrow up/down keys, select the required manufacturer (*Star*) from the *Manufacturers* table.
- Using the rotary move, go to the *Printers* table.
- Using the arrow up/down keys, select the desired printer type (*Star LC24-200 Colour*) and confirm with *ENTER*.



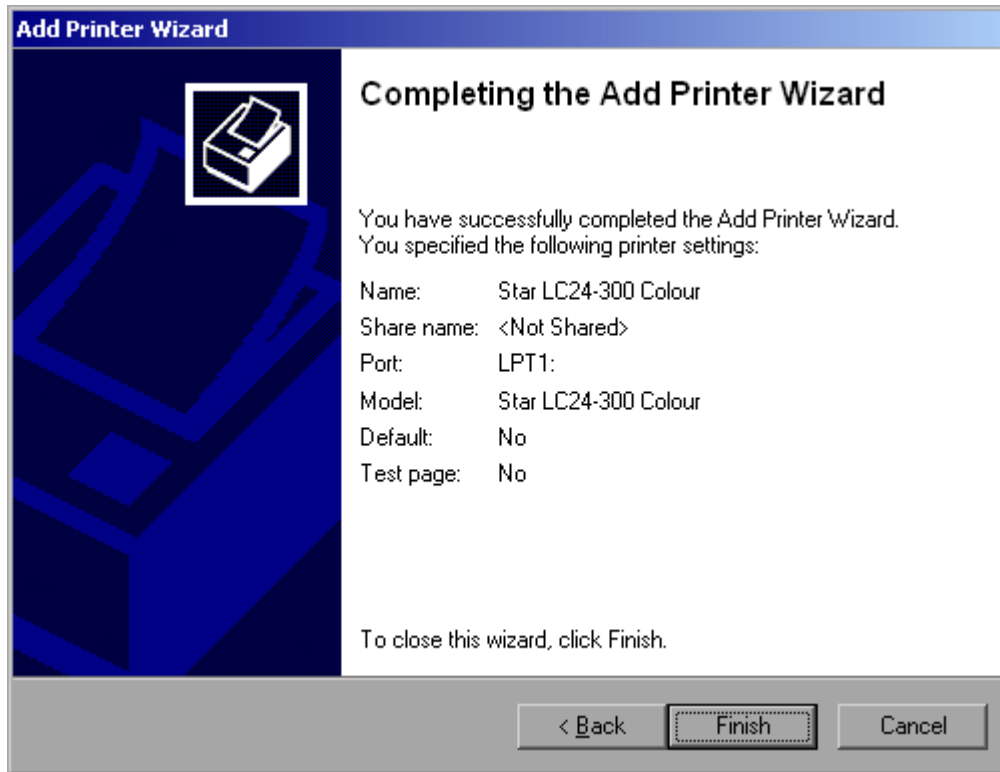
Note

If the desired printer type is not in the list, its driver has not yet been installed. In this case, click the *Have Disk* button with the mouse. You will be prompted to connect e.g. a memory stick containing the corresponding printer driver. Press OK and select the desired printer driver.



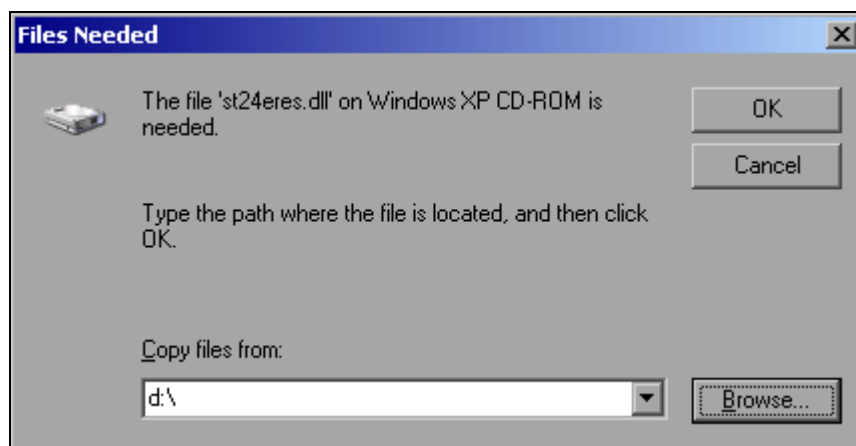
- You can change the printer name in the *Printer Name* field to any name you want (max. 60 characters). However, this requires using a PC keyboard.
- Using the rotary knob, select *Default Printer yes / no*.
- Using the arrow up/down keys, select the desired status.
- Confirm the entry with *ENTER*.
The *Printer Sharing* dialog panel will open.
- Confirm the entry with *ENTER*.
The *Printer Sharing* dialog panel will open.

- Exit the dialog panel by pressing *ENTER*.
The *Completing the Add Printer Wizard* dialog panel will open.

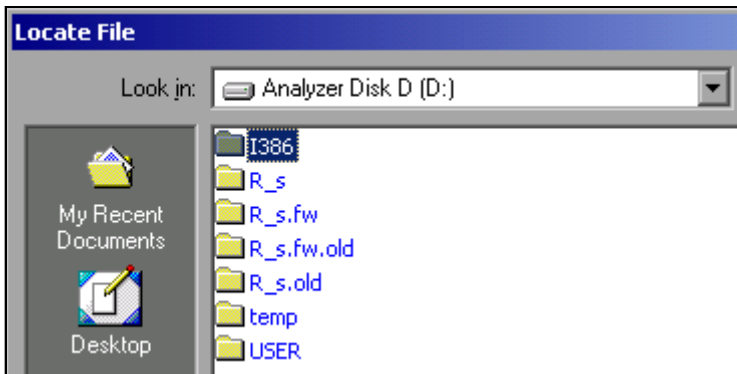


- Check the displayed settings and exit the dialog panel with *ENTER*.
The printer will be installed. If Windows finds the required driver files, the installation will be completed without any further queries.

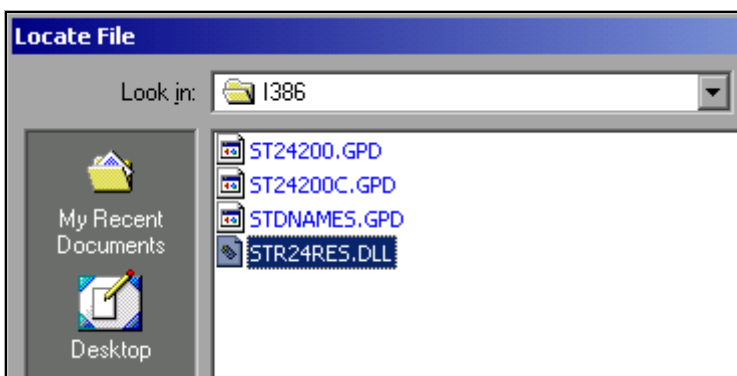
If Windows cannot find the required driver files, the dialog box for entering the path for files will open.



- Using the rotary knob, select the *Browse* button and confirm by pressing the rotary knob. The *Locate File* dialog box will open.



- Select the path D:\I386 by turning the rotary knob and then pressing it. If the background of the selection bar is not blue, the selection must be marked with the arrow up/down keys before the entry can be selected by pressing the rotary knob.

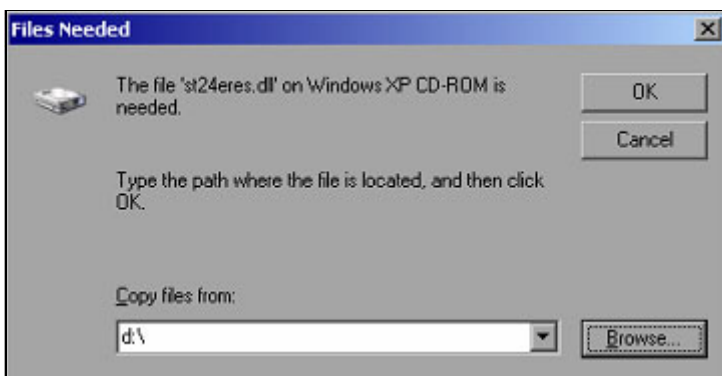


- Using the rotary knob, select a driver file and confirm by pressing the rotary knob. The file will be added to the *Files Needed* dialog box.



Note

If the file is not available in the D:\I386 directory, you will need e.g a memory stick containing the driver file. In this case, exit the dialog box with ESC and repeat the selection starting with the *Files needed* dialog box.



- Using the rotary knob, select *OK* and confirm by pressing the rotary knob.
The installation will be completed.

The instrument must then be configured for printout with this printer using the **DEVICE SETUP** and **DEVICE 1/2** softkeys in the hardcopy main menu (see section [“Selecting and Configuring Printers”](#) on page 2.17).

Network Printer

Network printer installation is described in chapter 6, section [“Installing a Network Printer”](#) on page 6.19.

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